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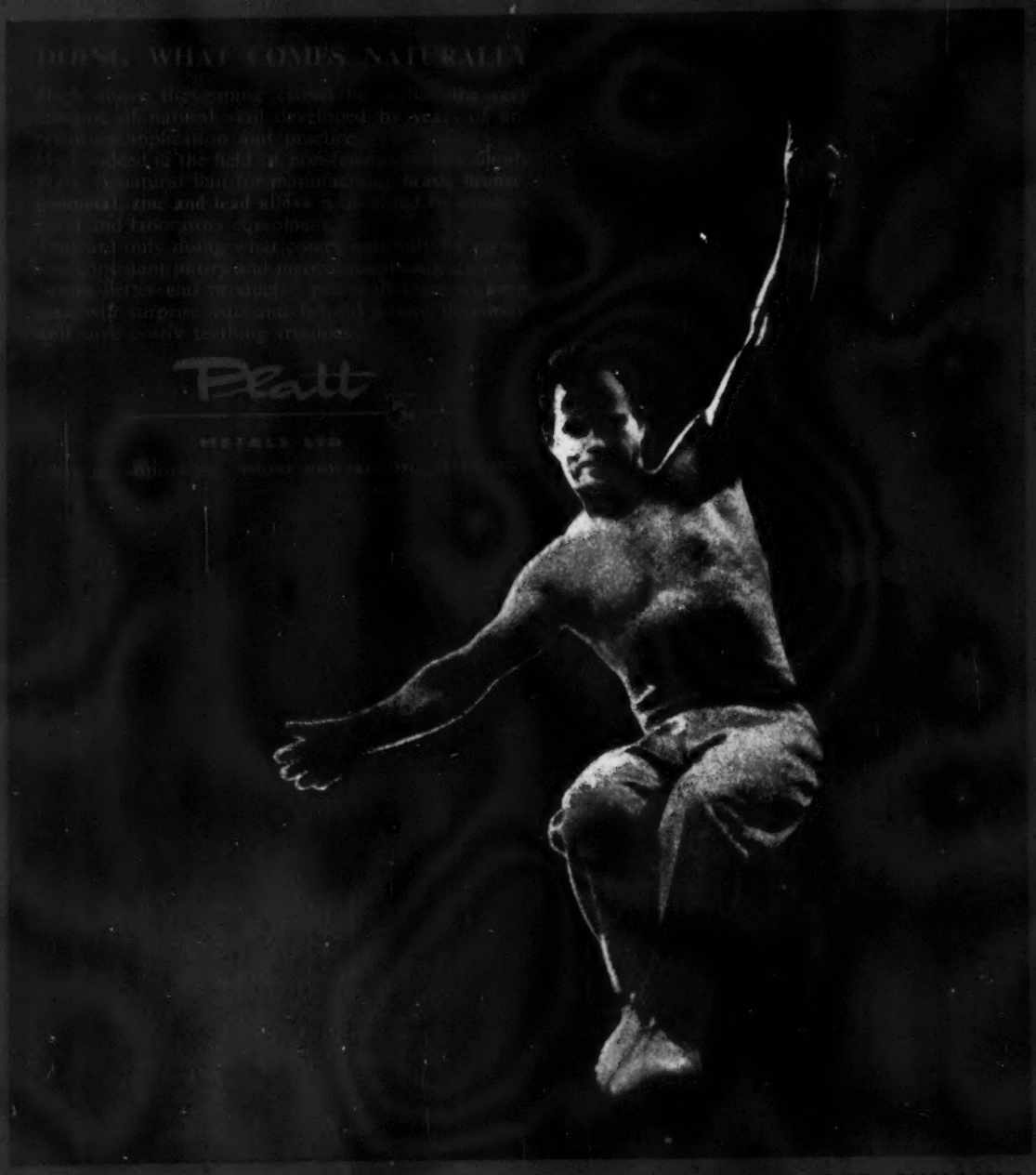
METAL INDUSTRY

THE JOURNAL OF NON-FERROUS METALS



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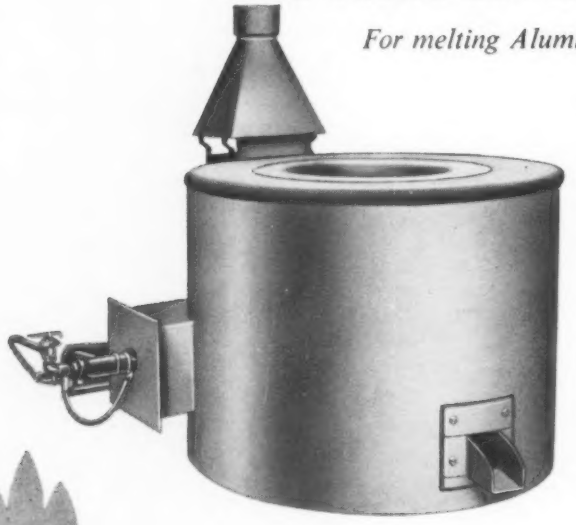

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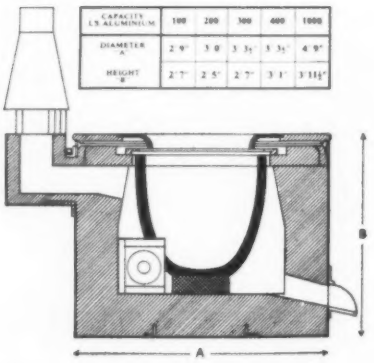

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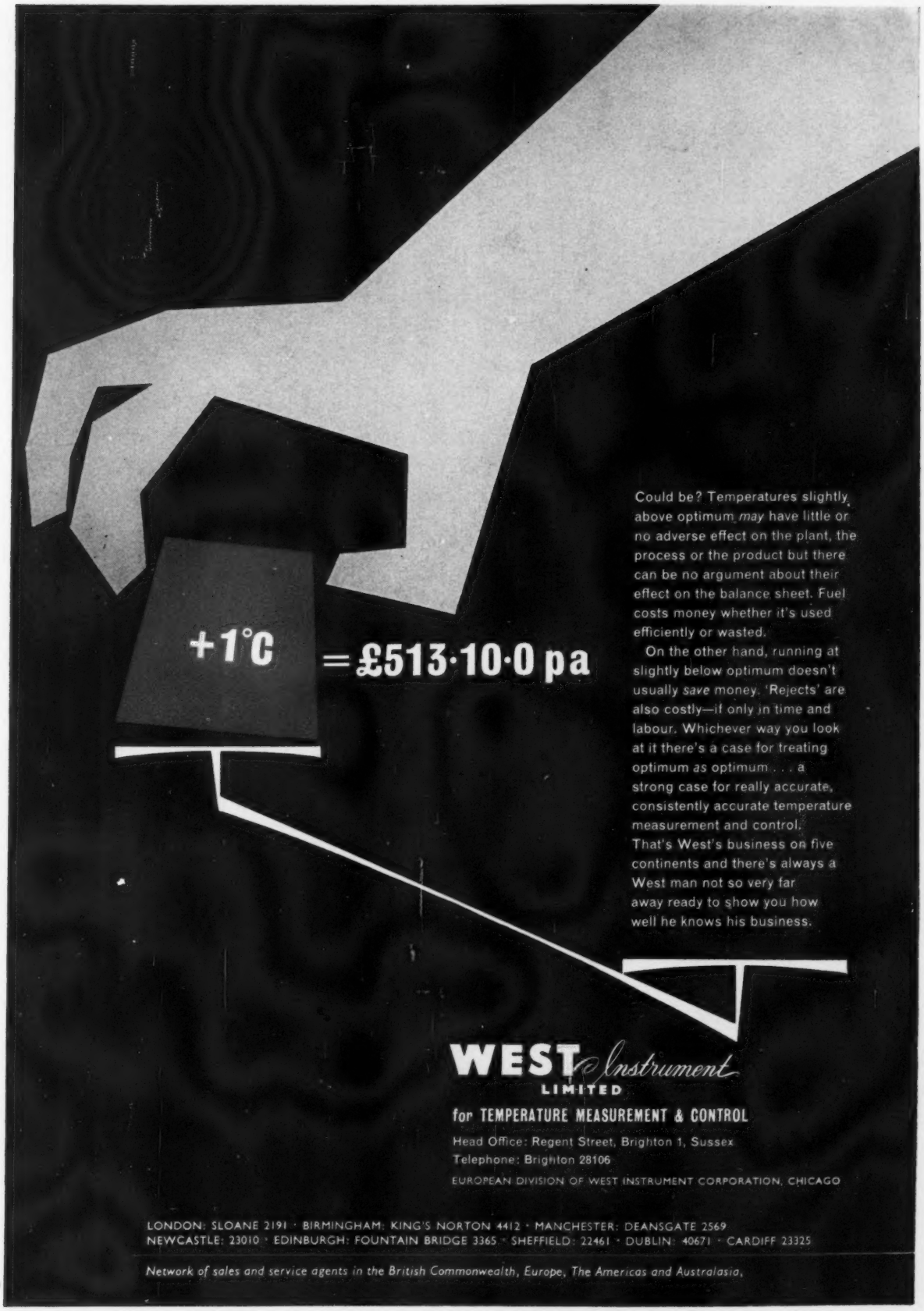

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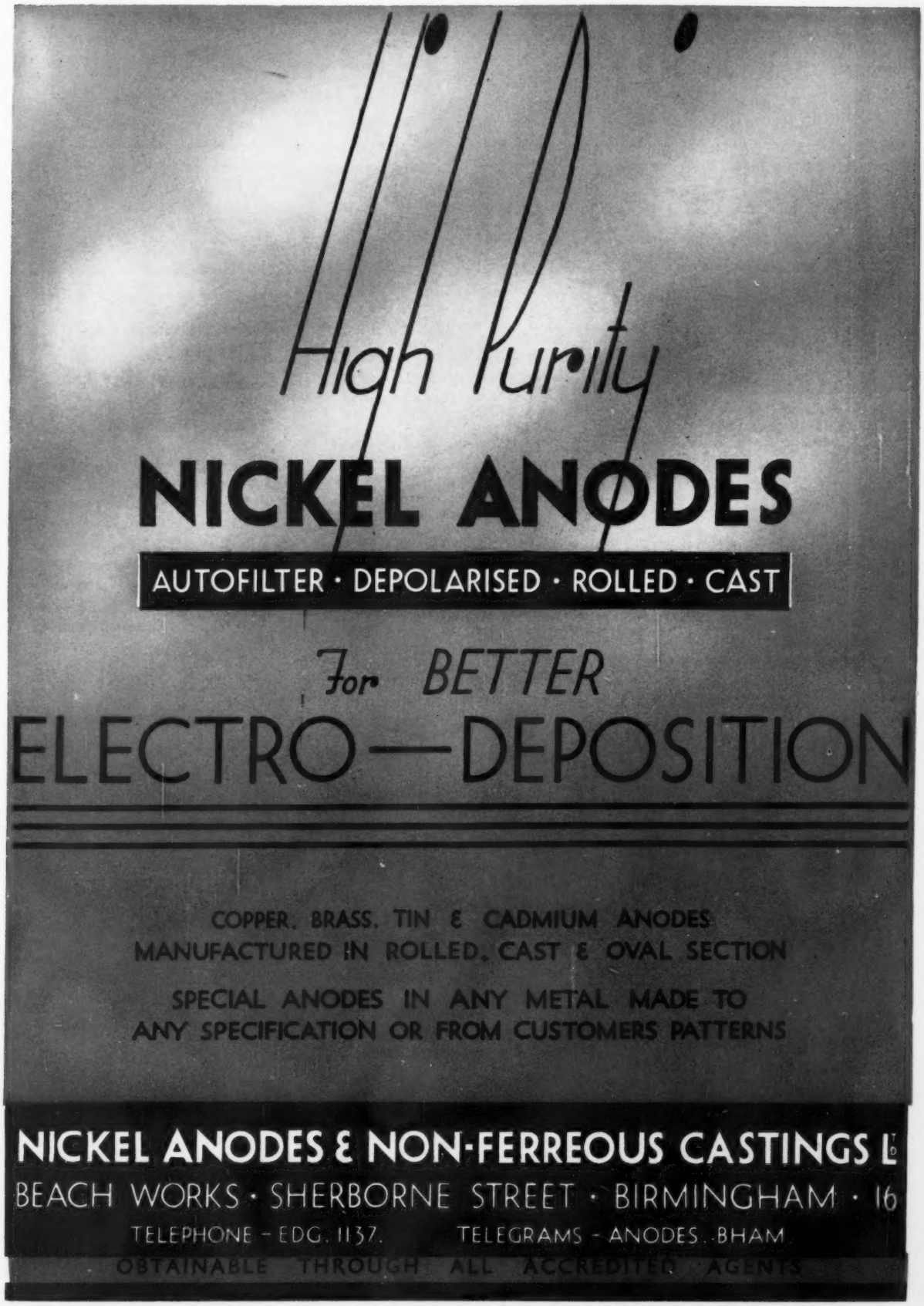
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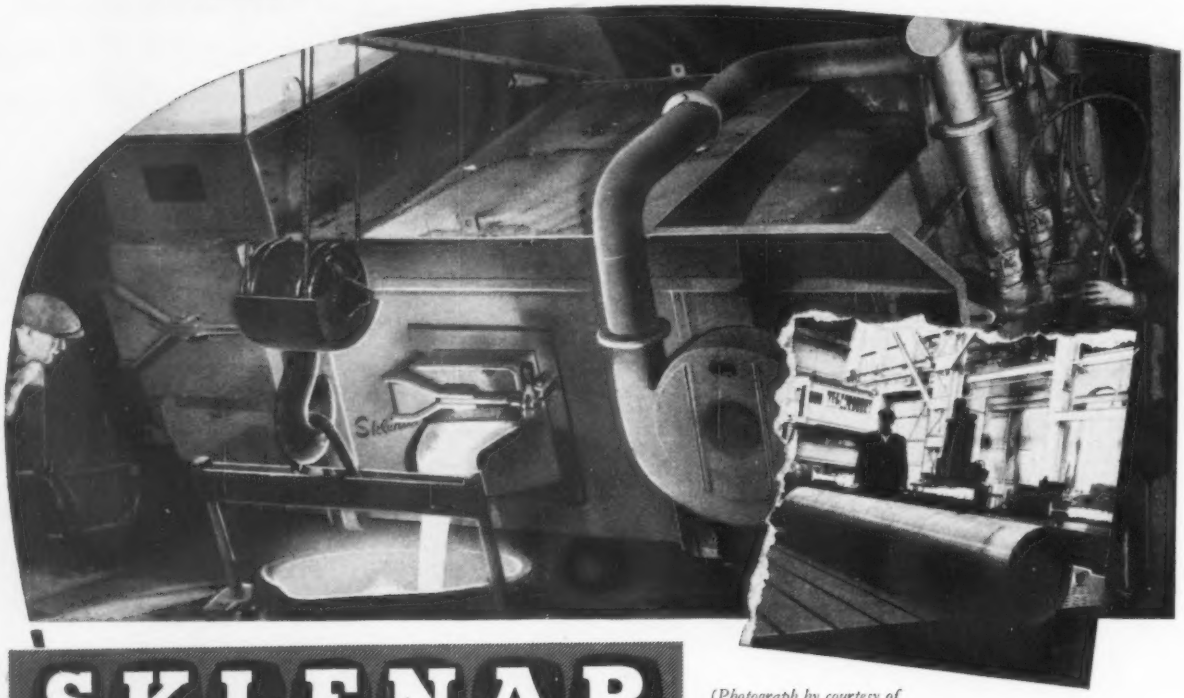

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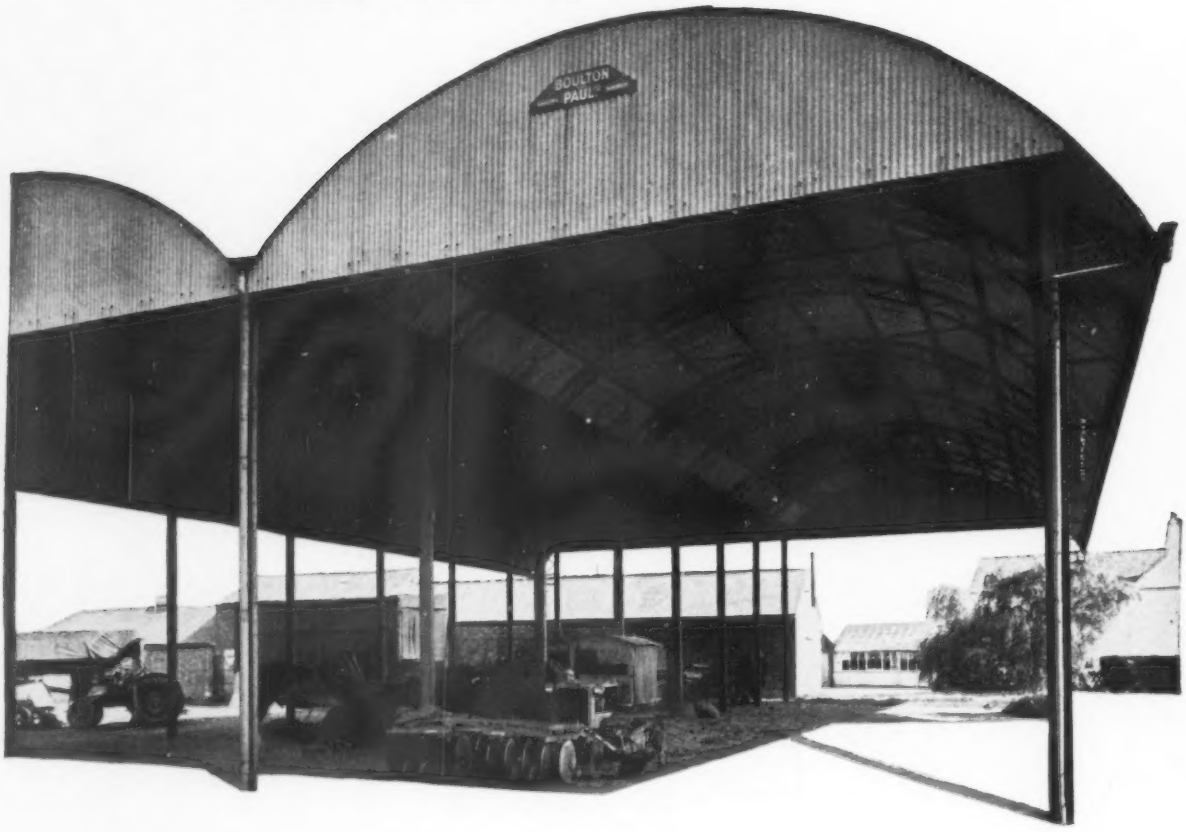

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Training for Management

IT has been taken for granted in these post-war years that its universities are Britain's principal source of scientists, engineers and technologists. It is not yet so readily recognized that the universities may also help directly to provide Britain with its managers; indeed, there are many, both within the universities and outside, who believe that "management" is not, and never can be, a field of study or action coherent enough to form an academic subject—and of these some believe that any university embarkation into these affairs must so threaten standards of scholarship as to demand active opposition. Not so at Manchester, where the College of Science and Technology of the University, catering annually for 500 graduates, is also planning to expand its Department of Industrial Administration, founded as far back as 1918. The first professor was appointed in 1955 and now Manchester takes the lead in business education by appointing a visiting professor in industrial administration, the first post of its kind in any British university. This new appointment closely interprets the traditional policy of the College, namely, to build the academic subject upon operational studies of the relevant technology in industrial Manchester and elsewhere.

Industrial management, administration, planning and control, with its identification of problems, its estimates of utilities, its processing of information, its specifications for action, all in the complex settings of personal and social conflict, is potentially a subject of the greatest intellectual rigour. It is irrelevant that the true research worker must use the language of management mythology, or that he must discuss non-scientific propositions with non-scientific managers; nuclear physics was heralded by alchemy, and astrology contained the seeds of Jodrell Bank.

There are three distinct contributions which a university can make to this subject. The first is by the researches of its staff, by study of problems of management, and by the analysis of the consultant's case-book, to extract basic teachable ideas and relate them to the research of others working in the same fields elsewhere. The second is to communicate these (in largely theoretical form) in the hope, not of teaching anything "useful" about management but that they will encourage students to seek the logical structure within which the underlying problems of management may be more clearly identified and progress may be more readily controlled. The third—the most difficult—is to study the processes themselves by which managers manage. A programme of seminars, to discuss such affairs as industrial morale and motivation, managerial control in all fields — cost, quality, sales, inventory, the Common Market, and so forth—to examine practical problems from a theoretical viewpoint, and to bring together the business man and the research worker, will be an important part of these developments at Manchester. Other institutions could well copy this example.

Continuous Casting of Aluminium Alloys

By W. M. Doyle, Ph.D., M.Eng., F.I.M.
(*Research Division, High Duty Alloys Ltd., Slough*)

(*Continued from* METAL INDUSTRY, 4 *August* 1961)

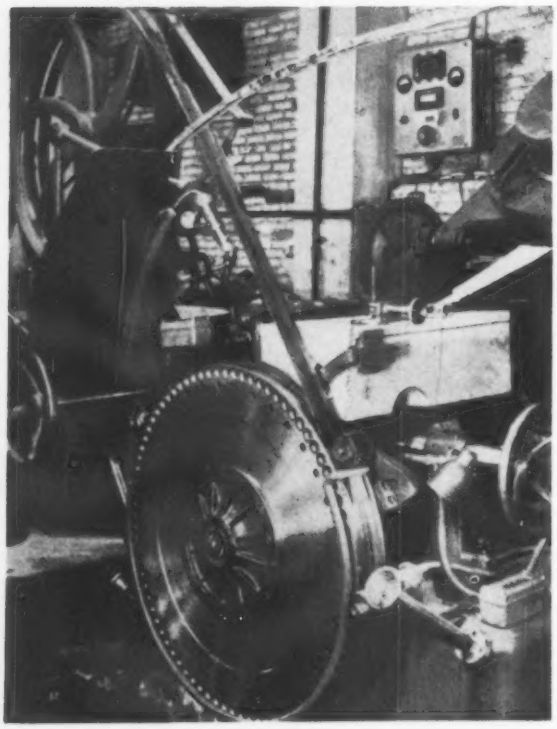
THE last decade has seen the successful introduction of machines for the casting of pure aluminium and low-alloy content alloys, which are characterized by the fact that they use a moving-mould. They are usually integrated or combined with rod rolling mills or strip rolling mills. These machines have taken many years to develop and they represent the fulfilment of the metallurgist's dream of pouring molten metal in at one end and producing saleable rod or strip at the other.

Each of these machines has its own particular function, which it fulfils better than any other, but the ultimate product required governs the choice of machine, and it is proposed to deal with a selection of the more important types according to the kind of alloy and form and size of product for which they are most suited.

One of the first moving-mould machines to compete successfully with conventional wire rod-rolling mills was the Properzi machine. It was developed by Ilario Properzi of S.p.A. Continuus, Milan, and it represents an extremely ingenious development extending over many years. The first unit produced cast bar with a section of 0·5 in^2, but the later machines produce a semi-triangular section of about 1·5 in^2. The integrated rolling mill consists of a 13-stand unit which is capable of reducing the 1·5 in^2 rod down to wire rod $\frac{3}{8}$ in. diameter. The machine[5] is illustrated in Fig. 7.

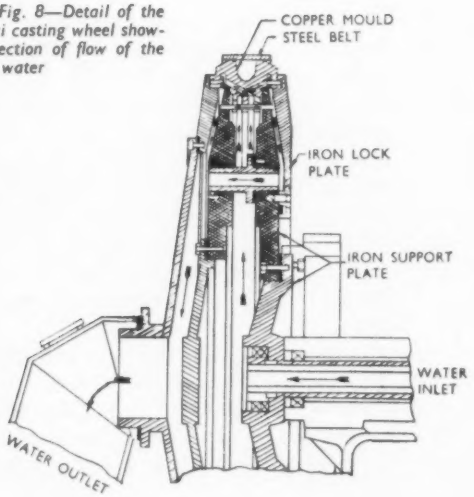
The holding ladle is a cast-iron pot of about 120 lb. capacity, from which metal is fed directly into the mould by means of a screw activated plug-valve. The actual mould is formed by a water-cooled casting wheel, which has a copper ring mould at its periphery and an endless steel belt, under tension, which covers the top of the copper ring mould over an arc of approximately 180°.

The casting wheel is kept full of water and the relatively thick, steel belt is cooled by a water-spray. The tip of the cast-iron feeding spout, coated with a refractory dressing, is slightly immersed in the pool of metal in the wheel cavity. Fig. 8 shows a detail of the casting wheel assembly described by Russell and Nichols,[6] and indicates the direction of flow of the internal cooling water. When casting commercially pure aluminium, about 40-60 gal/min. of water is used. The steel belts are made of mild steel about 0·1 in. thick. They are usually annealed and cold rolled to $\frac{1}{4}$-hard or softer temper and the belt life is about 25 to 45 hr. The inside surfaces of the ring-mould are coated with a layer of silicone, or with graphite, to prevent oxide pick-up. Air wipers and wiper pads are used to keep the belts free from water. The wheel speed is accurately controllable over the range of 1·75 to 6 r.p.m. The usual casting speed is in the range 24-36 ft/min. of rod, which is equivalent to approximately 3,200 to 4,700 lb/hr. The bar from the casting machine passes over the operator's head to a synchronized thirteen-stand rod rolling mill, where it is reduced to wire rod approximately $\frac{3}{8}$ in. diameter,



Left: Fig. 7—The Properzi continuous casting machine

Right: Fig. 8—Detail of the Properzi casting wheel showing direction of flow of the cooling water



and then to a typical power driven cable-reel.

Considerable difficulties were experienced when the Properzi machine was first put into production, but several ingenious design changes have been incorporated so that now the Properzi process is relatively simple and economical to operate in producing re-draw rod for wire in commercially pure and the near-pure type of aluminium alloys. Russell and Nichols[6] claim that the aluminium-magnesium-silicon (H.20) and aluminium-magnesium (N.4) type alloys are also being produced on a commercial basis but, so far, the higher strength alloys of aluminium have not been successfully cast in production. The process has been commercially used since 1955 in the production of aluminium rod and wire at the works of Unidaire Limited, Dublin.

The latter firm uses cooling sprays on the inside of the periphery of the wheel and, in addition, they have installed a secondary cooling box, just below where the bar enters the mill. This secondary cooling has enabled the production to run at higher speeds equivalent to 4,700 lb/hr.

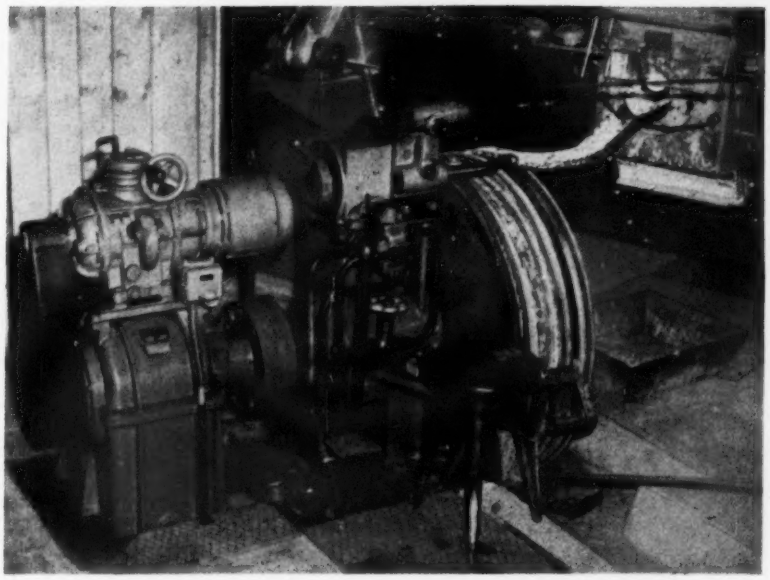


Fig. 9—The Rigamonti machine for the production of narrow cast slab or bar

Strip Production

Rigamonti has modified the Properzi machine to produce narrow cast slab or bar and the product emerges at just above floor level instead of above the operator's head, as with the Properzi machine.[5] An illustration of a Rigamonti machine is shown in Fig. 9.

This process uses a partially open wheel, which is water-cooled. The molten metal is fed to the wheel in the position shown in Fig. 9. The steel belt is cooled by water sprays and the operator controls the speed of the wheel, through an infinitely variable reduction gear, so that the level of the metal pool remains constant.

The cast slabs are usually 2 to 5 in. wide and $\frac{3}{4}$ to $1\frac{1}{2}$ in. thick, but it is claimed that 7 to 8 in. widths can be produced, but only with difficulty. The difficulty is associated with the necessity of directing the cast slabs to one side. With a molten metal temperature of just over 700°C., and a casting speed between 12 and 13 ft/min., the corresponding slab surface temperature is about 400°C. and the amount of cooling water used is between 18·5 and 26·5 gal/min. The strip passes from the casting machine to a hot-rolling mill, where it is reduced by about 50 per cent in thickness and coiled ready for cold-rolling.

The main disadvantages of the Rigamonti process are the appreciable surface exudation on the belt side of the slab and the rapid distortion of the steel belts, but it is in use at the Rigamonti Works in Milan and at the Fabrique d'Emballages Metalliques, S.A., Fribourg, Switzerland, John Dale Limited, St. Albans, and a modified installation is in use at Enfield Rolling Mills Limited, Bradford.

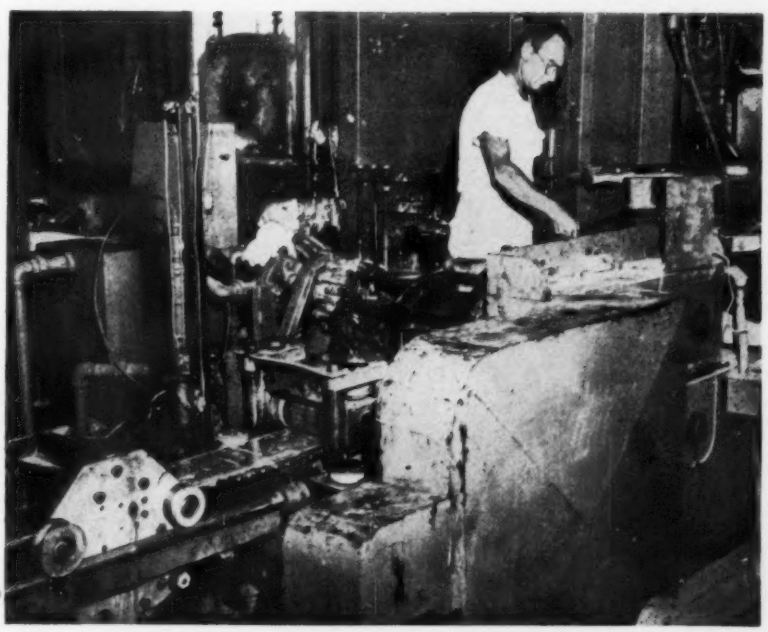
The main use of the Rigamonti slab-casting machine is in the production of commercially pure stock for the manufacture of slugs for impact extruded containers.

Hunter-Douglas Process

The Hunter-Douglas process[7] has been in successful operation for nearly ten years. It has been mainly used in the production of a low magnesium-silicide type aluminium alloy slab about 1 in. thick by 7 or 8 in. wide for subsequent rolling into Venetian blind strip.

The casting unit, Fig. 10, consists of two sets of mating half-mould sections with each section attached to the other by means of a chain link similar to caterpillar tractor treads and arranged so that one set of mould sections operates on top of the other to form a complete mould. The latter moves

Fig. 10—The Hunter-Douglas machine casting narrow slab for subsequent rolling



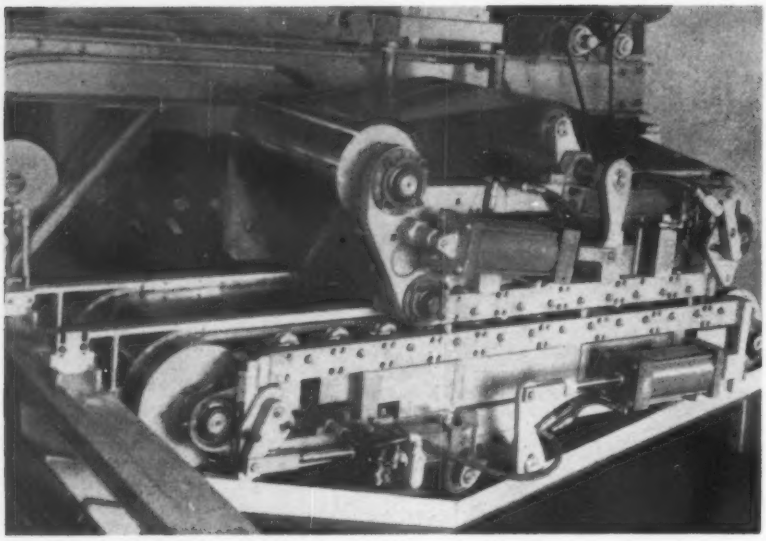


Fig. 11—The Hazelett continuous strip casting machine

along a distance of about 30 in. in a horizontal plane to allow solidification to take place. At the exit end of the machine, pinch rolls hold back the cast bar to compensate for the linear shrinkage in the mould cavity. The slab itself then passes into a holding-oven or through an integrated tandem rolling mill. Each half mould is machined to the required shape of the slab and is cooled by water circulating in the moulds by means of ingeniously arranged rubber hoses that revolve with the moulds from the main drive stand. The casting speeds are claimed to be between 4 and 15 ft/min., depending on the alloy being cast. Commercially pure aluminium can be rolled continuously or cut off into approximately 55 ft. lengths and held in a furnace at the rolling temperature. Only one annealing operation is stated to be required before cold rolling to final gauge for Venetian blind strip. This process has produced thousands of tons of satisfactory material for this special application at a very favourable price in a highly competitive market.

Hazelett Process

An account of the Hazelett and the Aluminium Laboratories Limited development of the Rigamonti process, known as the rotary strip-casting (RSC) machine, has been given by R. D. Hamer.[8] The patent rights of the Hazelett process, subject to licences previously granted, have now been acquired by Aluminium Laboratories Limited. Briefly, in the Hazelett process, molten metal is introduced between two mild steel endless flexible belts, about 0·030 in. thick, which are led, under tension, around suitable support rails and discs. The machine is shown in Fig. 11. The thickness of the cast slab is controlled by the distance between the 40 in. long adjacent parallel lengths of the two belts. The width is controlled by the position of side dams, which are small rectangular aluminium blocks threaded along stainless steel straps that travel on the surface of the lower belt. Cooling water is applied to both flexible belts, from the inside of the parallel straight sections, by a series of high velocity water spray jets tilted in the direction of the belt travel. A series of scoops along the belt ensures that only a thin high velocity stream of water of uniform temperature passes along the belt surfaces. On the casting side, the belts are dressed with a mixture of insulating material, which improves the surface-finish of the strip. The belts are changed every 8 hr. With a 36 in. wide machine, commercially pure aluminium strip, 1 in. thick, may be cast at the rate of 7 to 8 ft/min. This is equivalent to just over 70 tons of metal in an 8 hr. shift. It is claimed that commercially pure S.1C and N.S3 alloys have been cast at thicknesses of ½, 1 and 1½ in. by 30 in. wide at speeds of approximately 17, 8 and 4 ft/min., respectively. The strip is subsequently processed by cold-rolling and annealing, and the quality is claimed to be similar to that of conventional material.

The problems connected with the distribution of the molten metal uniformly across the width of the cavity between the belts are very great and it has been stated[8] that about forty different designs of distributors and modifications have been tested. The successful commercial production to date has been limited to S.1C sheet (99·35 per cent purity aluminium) and development work is proceeding with higher purity aluminium and with the aluminium-magnesium binary alloys containing up to 4 per cent magnesium. Trials have also been carried out with the lower alloyed types of aluminium-magnesium-silicon alloys such as H.9. It is believed that no insoluble metallurgical problems would be encountered in casting slab up 60 in. wide although most of the development work has been concerned with slab 30 in. wide.

References

5 E. Herrmann; "Handbuch des Strangiessens", 1958: Düsseldorf (Aluminium-Verlag).

6 J. B. Russell and F. R. Nichols; *J. Inst. Met.*, 1958-59, **87**, 209.

7 J. L. Hunter and R. A. Quadt; *Iron Age*, 1952, **169**, (15), 118.

8 R. D. Hamer; *J. Inst. Met.*, 1958-59, **87**, 219.

(To be concluded)

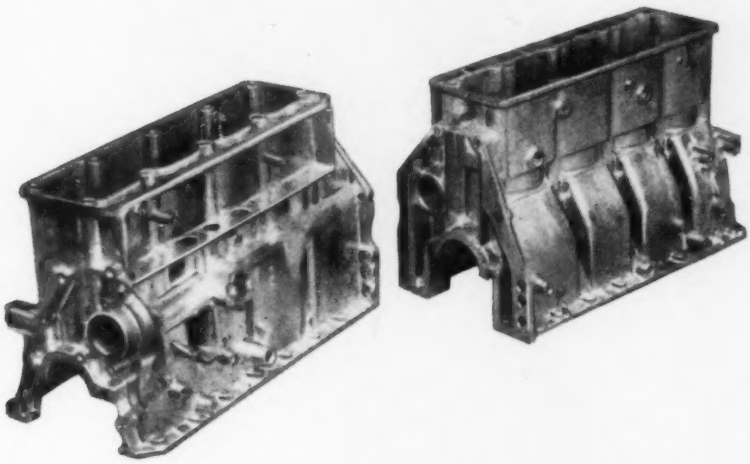
Aluminium Coated Strip

A PROCESS for producing aluminized steel strip has been developed at the Swansea laboratories of the British Iron and Steel Research Association, in which the quality of the product is claimed to be superior to any other known aluminized strip. The process is flexible, giving reliable coatings in the range 0·0001 in. to 0·001 in. thick on one or both sides. The coatings have an attractive appearance, are very uniform and since no appreciable alloy is present, bends of 0·020 in. strip can be made over a ⅛ in. mandrel without damage. The coating of aluminium is pore-free and can be anodized and dyed, or vitreous-enamelled with a single-coat low-temperature frit.

The raw material for the coating is commercially available aluminium powder. Although the powder costs about 50 per cent more than ingot aluminium, the commercial product is not likely to be more expensive than the hot dipped equivalent.

The process is carried out in three stages with a single pass. First, the powder is applied by passing the strip through a bath containing a liquid suspension of the powder. An electric current passing through the bath causes a migration of the powder towards the strip (electrophoresis). The deposit so formed adheres to the strip sufficiently for it to be dried and transported. The strip is then passed into a rolling mill for compaction — this is the second stage. A light pass only is necessary to give the coating adequate consolidation and a good appearance. The third stage is heat treatment, which is carried out in coil form by a new resistance heating technique. Excellent adhesion is achieved by means of a specified time/temperature cycle without significant alloying occurring, and the coating itself is rendered ductile and strong.

Casting the Volga Cylinder Block



WITH a locking pressure of 2,200 tons, a Triulzi cold-chamber pressure die-casting machine, claimed to be the largest in the world, was tested in the Triulzi Works at Novate, Milan, between July 17-22. It was producing the aluminium four-cylinder block for the 2½ litre Volga car for Russia. This was previously made as a gravity casting.

The casting itself weighed 22 kg. gross, with slug and runners, and 18 kg. nett when trimmed.

Cast iron cylinder liners will be pressed in after machining, when the block gets into production in Russia.

In the final production conditions, it is intended to heat-treat the pressure castings for stabilization, and every casting will be impregnated on the production line. The alloy used for the trials in the Triulzi works was: nickel 0·02 per cent, copper 0·119 per cent, silicon 8·75 per cent, magnesium 0·3 per cent, iron 0·4 per cent, manganese 0·4 per cent, balance aluminium.

In Russia it is intended to use a different alloy, similar to L.M.9, so that the injection plunger speed can be increased without welding metal to the die. The composition will be 12 per cent silicon, 0·5 per cent magnesium, 0·5 per cent manganese, and at least 0·8 per cent added iron.

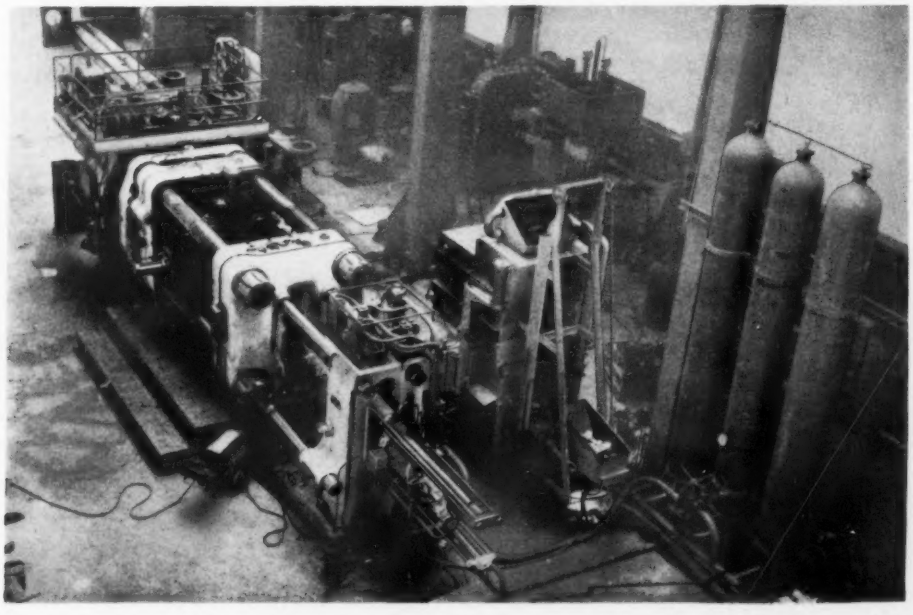
The die for the production of this Volga cylinder block was made in Marathon E38, hardened to 45 Rockwell, with a per cent composition of carbon 0·4, silicon 1·0, manganese 0·5, chromium 5·6, molybdenum 1·0, and vanadium 0·5 per cent.

The die was made at the works of Fonderpress, Bologna, in close co-operation with the Russian designers and Triulzi engineers. It is reported that it took 15,000 working hours to produce. The weight of the die was 13,800 kg. (approximately 14 tons).

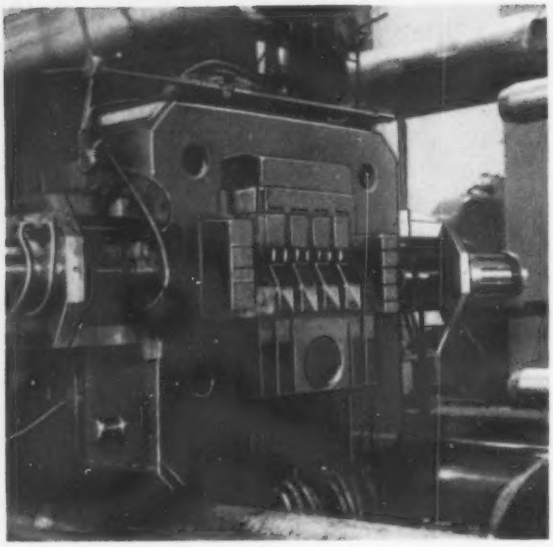
For the tests, the die was operated at a temperature of 230°C. in the middle of the cavity, die cooling being under thermostatic temperature control. The die lubricant employed was a mixture of graphite and oil, as also was the plunger lubricant. An air blast was also applied to the die during the machine cycle.

The casting itself was gated low on the inner edge of the flange to which the sump is fixed. The gate area was 4·6 cm^2.

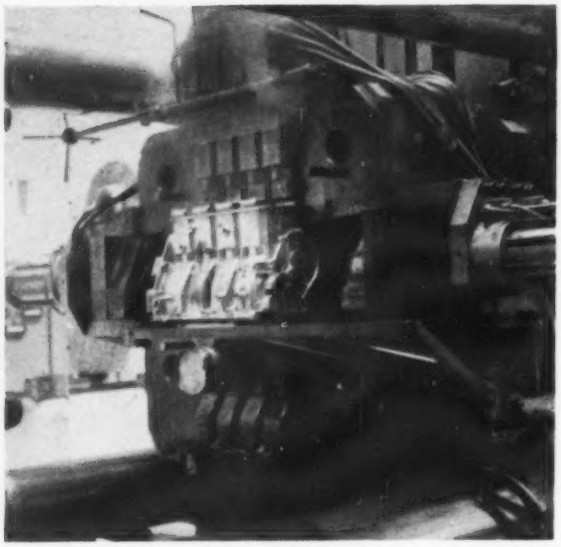
Relatively slow plunger speeds were used during the trials, but it is likely that this will be speeded up in Russia when the different alloy, with added iron, is employed to reduce the danger of welding (and incidentally produce greater corrosion resistance owing to reduced copper content).



General view of the recently tested 2,200 ton Triulzi pressure die-casting machine. The Dosomatic furnace unit is on the right of the machine



Half die in position on the machine platens showing the arrangement of the cores



Half die with the casting in position prior to removal and the cores withdrawn

Metal is fed to the machine from an automatic "Dosomatic" unit which enables completely automatic cycling to be adopted. This unit consists of a furnace and an automatic dosing device, graduated in kg. and gm.; after pre-setting the quantity of material to be ejected every time, this keeps constant within ±2·5 per cent.

Inside the dosing device, an inert atmosphere is kept in order to avoid any oxidation of the molten material. The ejection of molten material and its loading into the sleeve can be hand-controlled by means of a push button, or it can be arranged automatically by connecting the electric equipment of the "Dosomatic" to that of the die-casting machine, and by inserting this movement in the automatic cycle.

The unit is complete with electric control panel, which can be located in any convenient position for the operator.

The pressure on the metal employed in the tests was 890 kg/cm². With a plunger of 150 mm. diameter, an injection force of 150 tons was used.

This would suffice to produce a casting area of 2,500 cm², considerably more than the actual area of the cylinder block in question.

In Russia, it is intended to use only three operators—one operating in the normal way, a second removing the casting from the transfer system, and a third looking after the "Dosomatic" automatic ladling furnace.

The minimum cycle recorded during the test was approximately 4 min., with an actual cooling time of 35 sec. However, a great deal of time was spent in ensuring thorough lubrication of the die. When the die is properly run in, the Russians are satisfied that they can get 20 castings an hour from the machine.

The cycle of the machine was automatically controlled from clamping through to transfer of the casting, and included dosing of the metal into the cold chamber, core movement and injection.

The actual transfer mechanism consisted of a fabricated frame, pivoting on the outer edge of the die opposite to the machine operator. This was driven by a rack and pinion to come into position just below the cavity on the moving platen, so that the ejectors pushed the casting out on to the frame. The rack and pinion mechanism then swung the casting clear of the die.

The locking system of the machine consisted of four radially positioned wedges, locking into an annular ring around the main column at the end of the clamping stroke. This is followed by pressurization of a very small stroke ram at the front of the main column (stroke under 1 in.).

As the main column is moved forward by jack-rams, this system is highly conservative with water, and incorporates a positive mechanical lock in the form of the radial wedges.

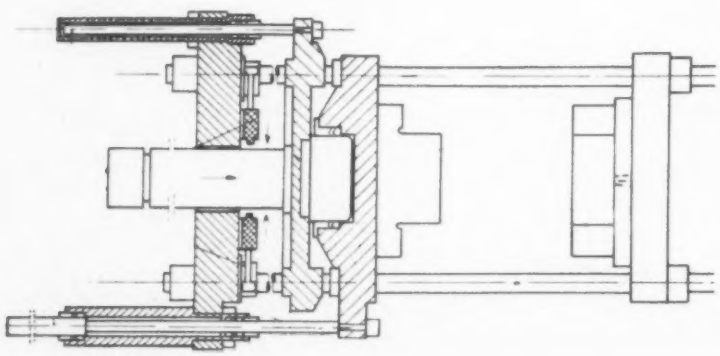
The central water plant consisted of two 120 litre pumps delivering 53 gal/min. and three 1,000 litre accumulators, with servo-controlled unloading valve for the pump and low pressure check-valve for the accumulators.

The injection pressure of the machine is infinitely variable between 170 tons maximum and 80 tons minimum. The platens of the machine itself are approximately 6 ft. square, with 51 in. between tie-bars. The die opening stroke is about 5 ft. The tie-bars of the machine are 11 in. diameter.

Two further machines of this type are scheduled for later delivery to the Volga factory in Russia.

Planning for two V8 cylinder blocks is already under way, and these can be produced on the same machine, which has adequate spare capacity to produce a larger casting.

Diagrammatic arrangement of the locking system of the 2,200 ton die-casting machine



MEN and Metals

The following have been appointed to the board of Nuclear Developments Limited:—**Mr. J. N. V. Duncan,** O.B.E., as chairman; **Mr. R. W. Wright, Sir Mark Turner, Mr. J. D. Pearson, Mr. A. A. Rubbra,** C.B.E., **Mr. L. Barman, Dr. J. Taylor,** M.B.E., **Mr. St. J. de H. Elstub,** C.B.E., and **Dr. R. L. P. Berry** as directors. **Mr. S. S. Smith** has been appointed executive director and general manager. Mr. Smith has been closely associated with nuclear engineering since 1941, when he made important contributions to the development of diffusion membranes for isotope separation. He has since been continuously concerned with research and development work on specialized nuclear engineering materials. The secretary to the company is **Mr. P. J. G. Elwes.**

It is announced that **Sir Douglas Thomson** has been appointed a director of Amalgamated Metal Corporation.

The council of the Iron and Steel Institute have decided to nominate **Mr. M. A. Fiennes,** M.I.Mech.E., group managing director of Davy-Ashmore Limited, for election as President for 1962-63. **Mr. H. W. A. Waring,** C.M.G., general managing director and deputy chairman of G.K.N. Steel Company Limited, has been elected hon. treasurer of the Institute, and **Sir Julian Pode,** deputy chairman and managing director of the Steel Company of Wales Limited, has been elected a Vice-President of the Institute.

Recent news from New York is to the effect that **Dr. Charles I. Whitman** is to join the Copper Products Development Association to become assistant technical director. Dr. Whitman comes from the General Telephone and Electronics Corporation, where for the last nine years he served three of its present subsidiaries as specialist in chemical, metallurgical and engineering research.

It is reported that **Mr. J. V. Bishop,** general manager of Jenolite, has been co-opted to the board of the Jenolizing Company.

Manchester University has taken the lead in business education by appointing a visiting professor in industrial administration. **Mr. Ronald Beresford Dew,** M.A., LL.B., has been chosen for this post. He is assistant managing director of Production-Engineers Ltd.

Chairman of the Consolidated Gold Fields of South Africa, **Sir George Harvie-Watt** has joined the board of the American Zinc, Lead and Smelting Company.

News from the Institution of Production Engineers is that the council of that institution has approved the following medal awards for the year 1959-60:—Silver Medal for the best Paper presented by a member to **Mr. K. J. Hume,** B.Sc., M.I.Mech.E., for his Paper on "Developments in Dimensional Accuracy; Silver Medal for the best Paper presented by a non-member to **Mr. E. P. Ward** for his Paper on "National Character Dictates Production Methods", and the "J. D. Scaife" Silver Medal Award to **Mr. H. Grisbrook,** B.Sc., A.M.C.T., for his Paper on "Precision Grinding Research".

Accepting an invitation to give the first annual lecture of the British Conference on Automation and Computation, **Dr. D. G. Christopherson,** O.B.E., F.R.S., Pro-Vice-Chancellor of the University of Durham, will speak on the subject "Mathematics—Friend or Foe?" at the Lecture Theatre of the Institution of Electrical Engineers, London, on Wednesday, September 27 next.

Previously economic and financial adviser (export), **Mr. E. J. Aaronson** has been appointed general manager, overseas operations, of The General Electric Company Limited.

Plate Shearing

TWO new ranges of shearing machines having larger capacities, the "Series 38" and "Series 50", have been introduced by Rushworth and Co. (Sowerby Bridge) Ltd. The first of these has a mild steel capacity ranging from 6 ft. by $\frac{3}{8}$ in. to 12 ft. by $\frac{3}{8}$ in., and the second from 6 ft. by $\frac{1}{2}$ in. to 8 ft. by $\frac{1}{2}$ in.

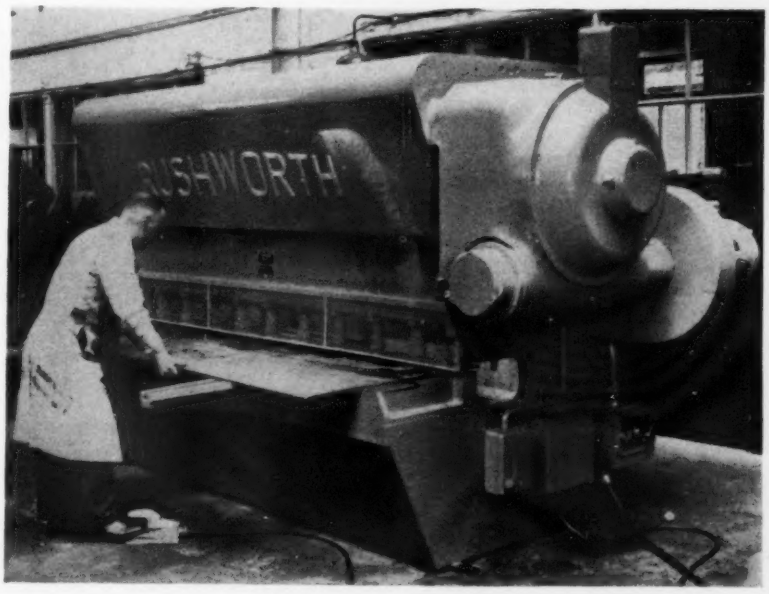
They are designed to give a very clean sheared edge by the provision of forward sloping slideways and a low rake angle of the top blade beam. The blades have four cutting edges and are adjustable over their full length.

The drive is by worm and wheel with wormshaft, the electric motor and flywheel being mounted coaxially. Transmission is by means of a multi-jaw dog type clutch which is solenoid operated and is controlled by either a foot switch or a pendant. The hold-down is effected by individual hydraulic plungers operated from a master unit.

Standard fittings include two table brackets for the front and two side guides for the top of the table. Lighting is provided on the cutting area and a waste chute to push cut off blanks away from the machine is fitted. A number of optional extras can be supplied, such as two 4 ft. long table brackets with floor supports, squaring arms from 4 ft. to 10 ft. in length, a shadow cutting line indicator and a dial-reading precision back gauge in lieu of the ungraduated standard gauge. This can be power-operated if required.

The "Series 38" range has a speed of operation of 50 strokes/min. in the smaller capacity machines and 37 strokes/min. in the larger capacity units while the "Series 50" models operate at 33 strokes/min. The depth of gap in all cases is 9 in.

The Rushworth "Series 38" guillotine shearing machine for sheet up to 12 ft. × $\frac{3}{8}$ in.



Products and Processes

Trends in the Development, Application, Processing, Design and Working of Non-Ferrous Metals and their Products

Miniature Air Cylinder

OPENING up applications for which conventional cylinders are too large, an air cylinder of ½ in. bore diameter, double acting, and available in three standard lengths of stroke from ½ in. to 1½ in., has been introduced by Air Automation.

It is arranged for rear manifold mounting and so is ideally suitable for mounting in confined spaces where there would be no room for pipework to ports.

The body is of brass and the rod of stainless steel, with synthetic rubber distributor type "U" seals on the piston, and a similar rod seal in the body.

Cable Clamp for Service Connection

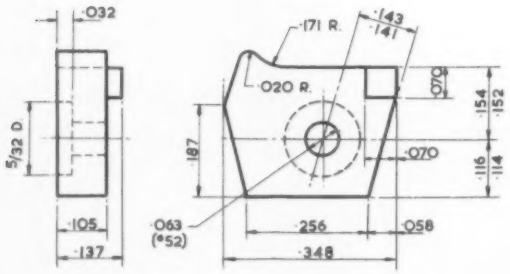
FOR use with Solidal cable, a clip-on type connection has been developed by Aluminium Laboratories Limited, to simplify the house-service connection. Solidal cable, which is plastics insulated and has solid sector-shaped aluminium conductors, has several features that favour simplified joint design. Unlike stranded cable, there is no necessity to take special precautions to ensure good electrical contact between individual strands. In addition, solid conductors can be drilled and tapped, and early development work was, in fact, centred around this feature. Work on various forms of stud-type connections was, however, abandoned in favour of the more efficient clip-on type. This new clamp is formed of two pieces of extruded aluminium section held together by high tensile steel screws. When screwed together, the two halves grip both the solid segmental conductor and the service conductor. Efficient contact is obtained without complete encirclement of the conductor, and this means that only very slight separation of the cores, up to about ⅛ in., is necessary. This elimination of the need for core separation is in itself a major advantage, since it permits big reductions in the sizes of joint boxes.

The new clamp has undergone rigorous load cycling tests at Aluminium Laboratories Limited, and these tests were arranged so that the behaviour of the joint interfaces between the main conductor and clamp and service conductor and clamp could be separately studied. The tests included during which resistance measurements were taken, and 10,000 cycles of half-hour heating and half-hour cooling, simulated short-circuit tests by the E.R.A. In the latter, a short-circuit current of 10·7 kA for 0·09 sec. melted the service conductor yet the joint remained stable. The clamps are being manufactured commercially by Erma Limited.

Powder Metal Cam

SMALL dimensions and tolerances as tight as ±0·001 in. presented production problems on a cam follower tip for a control switch. Pressed in a single operation to its final form, the part is moulded from 80 : 20 brass powder. The tip is a complicated polygonal form. An integrally moulded, 0·032 in. deep, countersunk shaft opening, 0·063 in. wide, runs through its thin (0·015 in.) section.

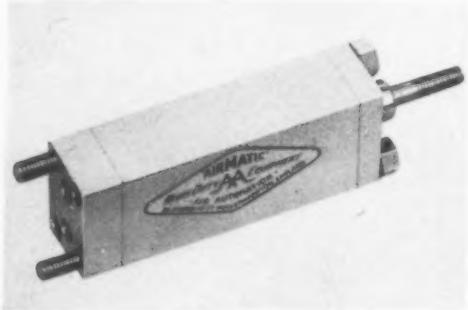
Compounding the difficulties encountered with this small piece were several exact dimensions. Radii of 0·020 in. on the curved tip, and 0·171 in. on the top curve, presented tooling problems which had to be overcome. An unusual detail of the follower tip is a moulded cubic appendage, 0·070 in. square by 0·032 in. thick, on the side opposite the countersink and flush with both one end and the top surface.

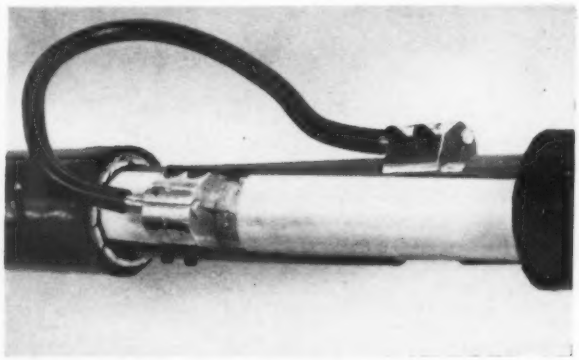


Left: Diagram showing form and dimensions of cam follower tip being produced from brass metal powder

Below left: The Airmatic miniature air cylinder for operation in confined spaces

Below: A loop connected with the new clip-on terminations for electrica load-cycling test





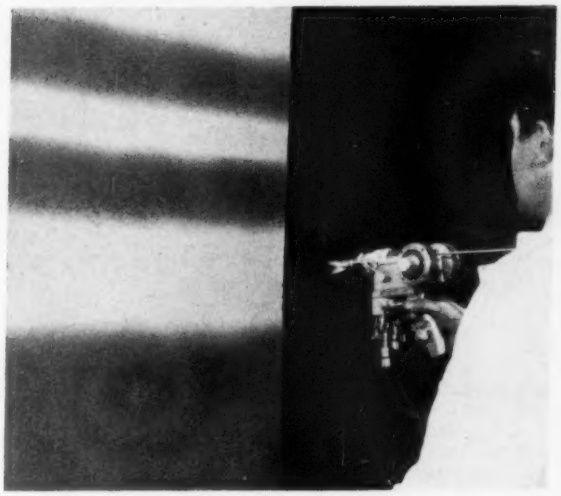
Brass powder was selected in this application for its excellent moulding properties, corrosion resistance, and relatively high tensile strength.

Aid to Metal Spraying

AT THE high delivery rates now possible in metal spraying, 60 lb/hr. and more of zinc and aluminium at equivalent coverage rates, it is of great importance that the metal is applied with the utmost economy. For this reason, Metallisation Limited have produced an auxiliary spreader nozzle for attachment to their Mark 33 metal spraying pistol. This will spread the spray stream from a $\frac{3}{16}$ in. dia. wire to an effective width of 3 in. at normal spraying distance.

In extended trials, the nozzle has proved of considerable advantage when coating large surface areas. The use of high throughput pistols for the spraying of small or complicated shapes is not recommended since the most economical and effective metal spraying depends largely upon selection of the most suitable size of wire.

Modern pistols, such as the Mark 33 are capable of using wires varying in diameter from 1 mm. to $\frac{3}{16}$ in. so that the selection of wire demands only the change of a nozzle. The new spreader attachment has an additional feature in that it may be switched on and off independently of the pistol.



Panel sprayed with one sweep of the gun under normal conditions (top) compared with a deposit (below) sprayed with the new spreader nozzle

Safety in Gamma Radiography

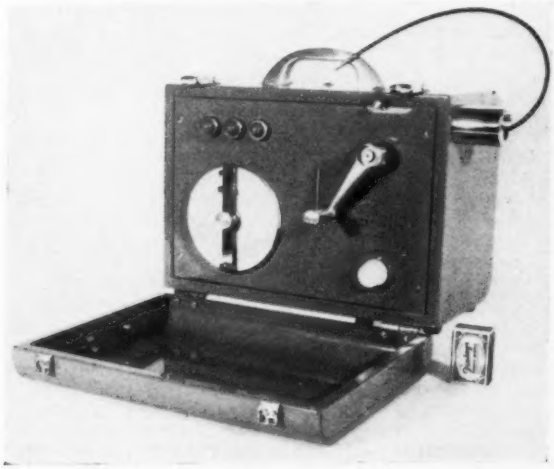
FOR checking work at various stages of production so that the number of rejects can be reduced or accidents prevented, gamma radiography is already widely used. Generally, two groups of gamma radiographic machines are used, the heavier for radiocobalt (Co^{60}) for inspection of heavier castings, heavy sections of metals (welds casting assemblies of from 1 in. to 8 in. of steel) and the "portable machines", which are convenient for site use, erection, and on the workshop floor, using iridium 192 as a source of radiation. This has a useful penetration up to 2 in. of steel or equivalent.

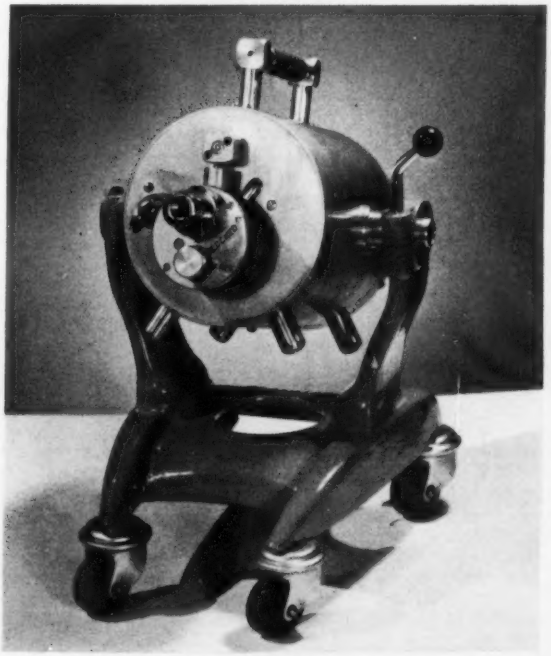
The shielding in most gamma radiographic machines up till now was lead. The newly published safety regulations (Ionising Radiations (Sealed Sources) Regulations 1961) specify shielding and operational safety which, if provided in lead, would make the equipment unwieldy, beyond "portability" even by two men. Tungsten provides in practice about 50 per cent better shielding than lead, and it is considered a good, available engineering material.

A typical gamma radiographic machine made wholly in tungsten has been designed by Pantatron Ltd. and is shown in the accompanying illustrations. It is portable and still provides good shielding. Its operational safety is vested in its design. The radiation source (iridium 192) can only be exposed by remote control, which can place the iridium source into any desired, even intricate, position (inside a pipe, or pipeline, in the middle of a set-up, or high up in cracking towers, etc.), all with the aid of a geared cable, of which several dozen feet can be housed and used from a simple control box.

Below: The Pantatron control box arranged with time switch for retraction of the source into the container

Right: The portable gamma radiographic unit with tungsten shielding to reduce weight





REFINING LEAD

SURVEY OF METHODS FOR THE REMOVAL OF BISMUTH

By J. F. Holmes, A.I.M.

BISMUTH can constitute a problem in the production of high-purity lead. Not only is it found associated with lead in many of the principal deposits but as the properties of the two metals are very similar, the bismuth is not removed by normal refining methods and passes almost completely into the lead. This problem has become more acute since the trend in metallurgy is increasingly to the commercial production of metals of high purity.

Most of the world's supply of bismuth is obtained as a by-product from the refining of lead, copper and tin ores. Western hemisphere production has averaged 2-3 million lb/yr.[1]

As lead has a low wastage from corrosion, a large proportion is recovered and returned to smelters for remelting and refining. Though there is little engineering scrap and an irrecoverable loss of the lead used in pigments, ammunition, bearing metals (in wear), and tetra-ethyl lead (in motor spirit), the recovery of lead used in storage batteries is about 85 per cent after some two or three years. Lead used in cable-covering and plumbing is recovered after a longer period of time.

There is, therefore, a tendency for the bismuth content of secondary lead to increase. The bismuth content of refined secondary lead at a large English smelter over a period of five months was found to be between 0·005 and 0·0133 per cent, with an average figure of 0·0096 per cent.

Scrap remelted ingots for refining had an average bismuth content of 0·011 per cent. Analyses of refined antimonial lead over the same period showed a lower content, viz., from 0·0018 per cent to 0·0185 per cent with an average of 0·0061 per cent.

Production of secondary lead at another refinery showed an average bismuth content of 0·012 per cent, with occasional batches as high as 0·018 per cent. Without some special refining to remove bismuth, it is generally felt that a limit of 0·01 per cent bismuth would be difficult to meet in normal refinery practice.

For most of the purposes for which lead is used, the presence of small amounts of bismuth is not detrimental and may even be beneficial. H. F. Collins[2] states that up to 0·1 per cent of bismuth in lead has a similar effect to copper and antimony in protecting lead against the action of cold sulphuric acid and that 0·1-0·35 per cent bismuth makes lead harder, somewhat crystalline and more fusible, while malleability is not affected by up to 2 per cent.

V. P. Mashoverts and A. Z. Lyandres[3] found that bismuth in lead-antimony alloys for the manufacture of accumulator grids was only harmful in large amounts.

Hoehne[4] studied the effects of small additions of bismuth to 5·5 per cent antimonial lead accumulator positive plates on voltage, life, efficiency and scaling, and found that both immediately after manufacture and after a 220-day rest that 0·006-0·23 per cent bismuth did not affect any of the above properties in these tests, but that detrimental effects were apparent on plates having large surface areas and became noticeable with a concentration of 0·37 per cent bismuth.

In corroding leads, however, bismuth is an objectionable impurity, giving a greyish colour to white lead made by the old Dutch process, a dirty colour to red lead and forming hard lumps in flake litharge.

A maximum of 0·05 per cent bismuth is called for in B.S.602 (1956) for lead for use in service and distribution pipes underground; in B.S.801 (1953) for lead for cable sheathing in alloys B, D and E; in B.S.504 (1944) for drawn lead traps.

A.S.T.M. specifications B.29-55 show the maxima for bismuth as given in Table I.

Debismuthizing is, therefore, only practised when specifications call for a bismuth content lower than that which would be produced by normal refining and not, as in the case of desilvering, for the value of the recovered bismuth.

Impurities found in lead include copper, zinc, bismuth, arsenic, tin, antimony, sulphur, iron, nickel, cobalt, tellurium, selenium and silver in small amounts. The arsenic and antimony prove the most difficult to remove; tin, sulphur, iron, nickel, cobalt and tellurium come next. Fortunately, these elements have a greater affinity for oxygen than has lead, and they can be removed by oxidation processes. This operation is generally known as "softening" or "improving" and can be effected by oxidation in a furnace, assisted by agitation, and in some cases by the introduction of litharge, or by the Harris process of refining with caustic soda and sodium nitrate.

Copper, however, has less affinity for oxygen and is only partly removed. It can be reduced to 0·005-0·006 per cent by a drossing operation at just above the freezing-point of the lead, and to better than 0·002 per cent by the addition of sulphur and the removal of the sulphide formed, again at a temperature just above the freezing-point of the metal. The silver and bismuth impurities do not respond, however, to these treatments and require separate processes for their removal.

Many of the processes which have been employed for desilvering lead are also capable of removing bismuth and are listed in Table II.

Cupellation is the oldest process and has been employed for over 2,000 years, but is no longer used as an individual method, on account of high losses and labour costs, unless silver is very high and there are valid reasons for not employing other methods. It can be used, however, with argentiferous bullion after Parkes' or Pattinson's processes have concentrated the silver[5].

The enriched lead is melted in an oxidizing atmosphere on a "cupel" of rammed bone-ash; the lead is oxidized to litharge which soaks into the porous bone-ash, leaving behind the silver. The bismuth concentrates in the metal until the last stages of the cupellation, when it is oxidized with the litharge. (An addition of refined lead may be necessary to remove the last traces of the bismuth.)

On reduction, the first skimmings of litharge yield lead very low in bismuth and silver, succeeding skimmings yield lead rather higher in these metals, and the final skimmings contain the bulk of the bismuth content of the original work lead.

The Pattinson process[6] of fractional crystallization was introduced primarily for separating silver from lead, but also removes bismuth down to 0·02 per cent.

Crystals forming in lead cooling in kettles are removed by means of a perforated ladle to another kettle until some two-thirds of the pot have been so transferred. The majority of the silver

and bismuth will then remain in the first kettle. The process is repeated in successive kettles; as bismuth concentrations are appreciably lower than those of silver, however, many operations are required. The process was superseded for desilvering lead when the Parkes' process[7] for desilvering lead was introduced in 1850, as much less labour was required and a large stock of lead was not tied up in the pots. The process was first used commercially at Llanelly in 1859.

Parkes showed that if zinc is dissolved in an argentiferous lead, separation into two layers occurred, the upper layer containing the bulk of the zinc with a little lead and the lower layer the bulk of the lead with a little zinc, and that the silver dissolved preferentially in the upper zinc layer, some 96 per cent of the silver passing into this layer.

A description of the operation of the process is given in Thorpes Dictionary of Applied Chemistry[8], and the subject more fully dealt with by Davey[9], who covered current practice with thermodynamic data and phase equilibria diagrams.

Unfortunately, the Parkes process does not remove bismuth as did the Pattinson process, and bismuth was no longer removed in the course of desilverization.

The Tredinnick process was a modification of the steam-Pattinson or Luce-Rozan process and was employed by Newnam in America to reduce the bismuth content of lead from 0·33 per cent to 0·05 per cent and to give an alloy of 10 per cent bismuth.

Oxidation-reduction processes have been used for freeing lead from bismuth. As the bismuth remains in the lead, the slag from oxidation furnaces is virtually free from this impurity. If the slag is reduced, a lead very low in bismuth can be obtained.

When special high-purity lead was required at Port Pirie, F. A. Green[10] stated that though the normal bismuth content of Port Pirie lead was very low, slag from the softening furnace was used as a source in this case. This was reduced to give a batch of hard lead very low in bismuth. The arsenic, antimony, copper, silver and zinc were removed by normal refining methods and a lead of 99·992 per cent purity, containing less than 0·0001 per cent of bismuth, was obtained.

W. J. Kroll[11] discovered that bismuth in lead would combine with various alkali and alkaline-earth metals, notably calcium, to form a compound, Ca_3Bi_2, having a high melting point, which could be removed as a dross from the bath.

In the process, calcium is added, preferably in the form of a calcium-lead alloy, which is stirred in at the right temperature, and the dross removed from the surface of the bath.

The process was developed commercially by J. O. Betterton[12] and the American Smelting and Refining Company, but difficulties were found in practice, in that the operation required particular skill since, if the temperature of addition of the reagent was too high, the mixing period too long, or if excess reagent was used, dross formation was too high and difficult to remove, resulting in high costs.

For lead containing less than 0·01 per cent arsenic and antimony, calcium was added in the following amounts:

Bismuth (per cent)	Calcium Addition (lb/ton of lead)
0·1	2·2
0·4	3·8
0·8	5·8
1·0	6·8

to reduce the bismuth content to 0·05 per cent.

W. J. Kroll pointed out[13] that the patented idea was much broader than the debismuthizing of lead and covered the elimination of impurities, especially arsenic, antimony, bismuth and selenium in metals by the addition of alkali, alkaline-earth and rare earth metals.

Betterton and Lebedeff[14] gave the details of the application of the process and the results of experimental data showing the extent of removal of bismuth by varying additions of calcium at 650°C., the effect of calcium in commercial work, excess calcium additions and the effect of adding the calcium in stages, also bath temperatures.

The calculation of the calcium-bismuth compound ratio in the final dross, as well as the required calcium additions to produce lead of less than 0·05 per cent final bismuth content from work lead containing 0·10-0·50 per cent bismuth, were also given.

The Paper emphasized that arsenic and antimony in the work lead should not together amount to more than 0·01 per cent, as these elements are preferentially removed by the calcium before any bismuth is eliminated, resulting in high dross formation and excessive reagent consumption.

Zinc below 0·3 per cent was found not to combine with calcium, though if present in concentrations greater than 0·3 per cent, 1 lb of calcium was required to remove 5·5 lb. of zinc at temperatures over 650°F. (308°C.); or 1 lb. calcium to remove 11 lb. zinc below this temperature.

Copper present to the extent of 0·001 per cent, or less, was found not to be removed and silver in desilvered lead only to a very small extent by the reagent.

The effect of additions of magnesium as a reagent for bismuth removal was also explored and found not to be effective with the concentrations normally found in lead, unless used in uneconomic quantities.

Magnesium was shown to be useful, however, in treating high bismuth leads produced by segregated smeltings. Addition of magnesium-lead alloy containing 12·40 per cent magnesium was made in two stages of approximately 3·7 per cent and 3·1 per cent to a lead containing 4·12 per cent bismuth and a lead of 0·78 per cent bismuth produced.

The amount of magnesium additions required to reduce leads with from 1·5-6·0 per cent bismuth to 0·7 per cent was determined.

When calcium and magnesium were used together it was found to be possible to reduce the bismuth to lower concentrations than with either reagent alone. A ratio of calcium to magnesium of approximately 1 : 1 was found to be most effective.

The operating procedure, as described by Betterton and Lebedeff, for debismuthizing lead with calcium and magnesium consists of pumping the work lead, previously softened, desilvered and dezinced, to the kettle and skimming carefully to remove any dross; then small amounts of "cooling dross" (dross formed on the addition of reagents) and "bismuth dross" from preceding charges are added to the kettle and stirred in at a temperature of 420°C.

Drosses formed are skimmed off, and if judged to be over 20 per cent bismuth from the appearance of a fractured sample and previous history of the drosses added, are retained for bismuth recovery; if appreciably lower than

TABLE I—A.S.T.M. MAXIMUM FOR BISMUTH

Corroding Lead	Chemical Lead	Acid Lead	Copper Lead	Common Desilverized		Soft Undesilverized Lead
				Lead A	Lead B	
0·05	0·005	0·025	0·10	0·15	0·25	0·005

TABLE II—DESILVERING PROCESS FOR LEAD

Pyrometallurgical Processes	Electrolytic Processes
1. Cupellation	1. Betts process
2. Pattinson process	2. Sulphamic acid bath
3. Tredinnick or Luce-Rozan process	3. Pyrophosphate and other baths
4. Oxidation-Reduction process	
5. Kroll-Betterton process	
6. Jollivet process	
7. Dittner process	

TABLE III—CALCIUM AND MAGNESIUM ADDITIONS

Bismuth Content Original Metal (per cent)	Calcium and Magnesium (lb. each)	Bismuth Content Original Metal (per cent)	Calcium and Magnesium (lb. each)
0·10	1·3	0·60	2·4
0·20	1·5	0·70	2·65
0·30	1·7	0·80	2·9
0·40	1·9	0·90	3·15
0·50	2·15	1·00	3·4

20 per cent bismuth, the drosses are returned to subsequent charges.

The authors state that the "bismuth dross" would be returned twice if the original lead contained 0·05 per cent bismuth, and three or four times if it contained 0·1 per cent bismuth, and point out that bismuth drosses become oxidized if allowed to stand for prolonged periods, particularly in moist air, and that there is no gain in circulating such drosses.

After the bismuth dross has been removed, the required quantities of calcium and magnesium reagents are added—the magnesium in the form of the metal submerged in a perforated basket, on which a stream of molten lead is impinged from a pump. The calcium is added to the surface of the bath in the form of a calcium-lead alloy (the manufacture of which is described later) at the same time as the magnesium.

Betterton and Lebedeff quote additions of calcium and magnesium to reduce the bismuth content to 0·02 per cent, as shown in Table III.

Excess reagents should be avoided as they lead to high dross formation, which is difficult to separate.

The charge is then mixed for some 30 min. at 365°C. and prolonged stirring avoided, as this also results in excessive dross formation.

The resulting "reagent dross" is removed at 365°-355°C. and retained for return to the succeeding charge. The bath is cooled practically to freezing, while the kettle sides are scraped thoroughly. This dross and the "edge" of frozen metal are removed as "cooling dross" for return to the succeeding charge.

The kettle is then reheated and the sides again scraped, the dross being added to the "cooling dross". The lead should then contain about 0·20 per cent bismuth and less than 0·05 per cent calcium and magnesium.

The residual calcium and magnesium can be removed by chlorination, either with chlorine gas or with suitable metal chlorides, or by an oxidation treatment with caustic soda and nitre, with air or steam.

References

1 W. C. Smith; "Bismuth and Bismuth Alloys", p. 526, "Encyclopaedia of Chemical Technology", (ed.) E. Kirk and D. F. Othmer, Interscience Publishers Inc., New York, 1948.

2 H. F. Collins; "The Metallurgy of Lead". Chas Griffin & Co. Ltd., London, 1910.

3 V. P. Mashoverts and A. Z. Lyandres; *Zh. Prikladnoy. Khim.*, 1948, **21**, (4), 347.

4 E. Hoehne; *Metallwirtschaft*, 1944, **23**, 5/8, 99, 60.

5 R. G. Bowman; "Handbook of Non-Ferrous Metallurgy", 2nd Edn., McGraw-Hill Co., New York, 1945.

6 British Patent 6497, 1833.

7 A. Parkes; Patents in 1850, 1851 and 1852.

8 Thorpe; "Dictionary of Applied Chemistry", 4th Edn., vol. 7, p. 224, Longmans, Green & Co., London, 1946.

9 T. R. A. Davey; "Debismuthising of Lead", *Trans.A.I.M.E., J. of Metals*, 1954, July, **6**, 838.

10 F. A. Green; Preprint Paper 9, p. 21, "The Refining of Non-Ferrous Metals", Inst. of Mining and Metallurgy Symposium, London, July, 1949.

11 U.S. Patent 1428041 (1922), 1853534-5-6-7-8-9, 1853540-1-2, 1989734 and 2032788. Ger. Pat. 410533. "Precipitations in Metal Solutions", *Metall und Erz.*, 1922, **19**, 317.

12 U.S. Patent 1941534-5, 1934.

13 W. J. Kroll; 66th General Meeting, Electrochemical Society, New York, 1934. Preprint 1934, p. 187.

14 J. O. Betterton and Y. E. Lebedeff; *Trans.A.I.M.E.* 1936, **121**, 205.

(To be continued)

Standard Specifications

Dosemeters for Protecting Workers from Radiation (*B.S.*3385 : 1961). *Price* 3*s.*

LAYING down requirements for direct reading personal dosemeters for X- and gamma radiation, B.S.3385 will be welcomed by all those responsible for the health and safety of workers exposed to radiation hazards. These instruments fit into the pocket, and tell the user the amount of radiation dose he has received—if any. Obviously, it is essential that these instruments should be robust and accurate, and the requirements of B.S.3385 are intended to ensure that they are.

A note in the foreword draws attention to the effect of beta radiation on measurements of gamma radiation dose and recommends that when the dosemeter is used in the presence of beta radiation, an appropriate sleeve should be fitted to the instrument. It also points out that unsealed instruments may be seriously affected by large changes in humidity, changes in atmospheric pressure, and by the presence of significant concentrations of radioactive or ionized gases. In such circumstances, it is recommended that a sealed instrument should be used.

A companion standard, for film badges, is in course of preparation.

B.S.3385 is the first British Standard to be prepared under the authority of the newly-formed Nuclear Energy Industry Standards Committee of the British Standards Institution. Under the direction of this committee, several technical committees are at work, dealing with nuclear terminology, units and symbols, protection against ionizing radiation, nuclear reactor safety and radioisotopes.

Classification and Methods of Sampling and Testing of Insulating Refractory Bricks (*B.S.*2973 : 1961). *Price* 6*s.*

DEALING with the classification, sampling and testing of insulating refractory bricks this standard points out, in a foreword, that the first consideration in selecting the most appropriate insulating refractory for any application must be the limiting service temperature. For any given limiting service temperature, the values for other properties may differ in materials of different manufacture, and the refractory material should be selected with the combination of properties most suitable for the application in question.

The system of classification specified in this standard is based on the behaviour of the refractory material in the permanent linear change test conducted at a specified temperature. The method of determining the permanent linear change is given, there is a page on sampling, and methods of determining dimensions, warpage (which includes convexity and concavity), bulk density, cold crushing strength, modulus of rupture, and thermal conductivity are given.

Copies of the above-mentioned standards may be obtained from the British Standards Institution, 2 Park Street, London, W.1.

OUT OF THE MELTING POT

Inspiring

ADVANCE notices of scientific research are always a little annoying, although those of the indirect type are less so. Thus, for example, a description of a new type of apparatus, with no examples of its application, leaves one with the pleasant anticipation of meeting such examples in the future, and, since the field is still wide open, may even inspire one to have a go for oneself. An instance of this kind is provided by the description by N. M. Rodigin, of the Institute of Metal Physics of the Academy of Sciences of the U.S.S.R., of an apparatus for the ultra-high-speed heating of metal specimens. The apparatus, which, incidentally, is fed from normal 50-cycle A.C. mains, consists of two interconnected units. The first of these serves for the generation of the current pulse and the second for the transformation of the pulse and its utilization for the direct (resistance) heating of the specimen. The first unit comprises a thyratron-controlled ignitron, which serves to make and break the main circuit, and a phase shifter. With this arrangement it is possible to obtain, for example, a current pulse corresponding to the maximum potential of the supply current and with a duration of one-quarter of the cycle, i.e. 0·005 sec. The second unit comprises a transformer with a primary winding to which the current pulse from the first unit is fed, two secondary windings, one of which is connected to the specimen to be heated and the other to a variable resistance by means of which it is possible to control the specimen temperature, and, finally, an auxiliary winding, which is connected to a D.C. source and serves to produce a predetermined degree of magnetization in the transformer core prior to the arrival of the current pulse. With this transformer, saturation of the core can be reached in a time less than the duration of the pulse, e.g. one-fifth, which means that the specimen will reach the maximum temperature, e.g. 1,000°C., in 0·001 sec.—a rate of heating of one million degrees per second. The apparatus can heat 0·8-1·5 mm. diameter, 20 mm. long steel specimens to quenching and melting temperatures. If the specimens have to be quenched, they can be heated in the quenching medium, e.g. water, since the loss of heat during the very short period of heating is negligible.

Small

NOW that they have been studied, on and off, for a number of years, the effects of ultrasonic vibrations on the heat-treatment of metals may well be expected to burst upon an unsuspecting metallurgical world as a sensational recently developed process destined to put everything else in the shade. In actual fact it is only a matter of developing suitable equipment, a task which, in the present state of the science and technology of ultrasonics, is well within the bounds of the practicable. The rest is just a matter of claiming results. There is no doubt that results would be there to be claimed. This fact will be known to the less unsuspecting section of the metallurgical world, who, however, will also be aware that, excepting a not very likely "breakthrough" or merely an excess of publicizing zeal, such results are far from spectacular. Some improvements in mechanical properties have been obtained by the application of ultrasonic vibrations during hardening and tempering of steels. Surface hardness and depth of hardening are increased by quenching in oil agitated by ultrasonics. (An ultrasonic cleaning bath might be adapted for this application.) Precipitation hardening of alloys is accelerated by ultrasonics and the mechanical properties developed as a result are increased. Finally, ultrasonics also intensify diffusion surface treatments such as carburizing, nitriding, and the like. In most cases, however, the results are small to marginal. Any consideration of them must also take into account the various limitations imposed on such heat-treatments by the characteristics of ultrasonic vibrations in regard to shape and size of the parts to be treated, their location, etc., and, of course, the additional costs. All this adds up to something that can be justified in cases in which even relatively small improvements are invaluable. That is what any possible future sensational claims will gradually reduce to.

Contribution

DESTRUCTIVE criticism is only useful as a beginning. Such criticism of the current rush to acquire equipment for research at high pressures and temperatures (this page, METAL INDUSTRY, 28 July 1961, p. 68) for example. It may, however, also inspire a few thoughts; even on the part of the critic. There can be little doubt regarding the desirability of research on the effects of high pressures, but no overwhelming reason why these should always be as high as possible. There is still a great lack of knowledge regarding effects of pressures well below those currently attainable. Such pressures can be achieved with equipment that need not be as expensive as that designed for the near-ultimate. An even more important consideration is that such equipment could provide a much larger working space and therefore permit wider experimental latitude. This, in turn, should permit a range of investigations beyond the current preoccupation with phase changes and properties. Instead of some hoped-for miraculous transformations, investigations could be directed towards an examination of the behaviour of materials, and the characteristics of processes at elevated pressures. A start has already been made on the study of the plastic deformation of metals, e.g. by extrusion or rolling, under hydrostatic pressure. Then there are the various dynamic properties of materials. What, for example, would be the behaviour of a test-piece under high hydrostatic pressure when subjected to fatigue stressing? Would there be any effect on the formation and growth of fatigue cracks? Would the vacancy mechanism of creep be affected by pressure? As for processes, the melting and solidification of a metal under hydrostatic pressure might be investigated, and that in spite of all the studies of pressure die-casting and the like. That is just a little constructive criticism to be going on with.

Skimmer

Industrial News — Home and Overseas

New Product

A new carbon monoxide detector-plate has recently been introduced in Denmark. It consists of a small 5 by 5 cm. plastics plate with a disc-like insert containing a special sensing substance, the active principle of which is palladium chloride suspended in a silicagel of the same yellow tint as the plate. In the presence of a carbon monoxide, the palladium-salt is reduced and the insert turns grey or black, depending on the degree of concentration of the gas. Carbon monoxide in a concentration of 0·01 per cent takes less than 15 min. to detect; 5 min. if the concentration is 0·02 per cent. Detection is practically immediate when this proportion reaches 0·05 per cent.

After blackening by influence of carbon monoxide, self-regeneration will take place by oxygenation through exposure to non-contaminated air for 20 min. to 2-3 hr. The plate can be used several times before losing its efficiency. Blackening after exposure to impurities of the air (hydrogen sulphide) involves loss of efficiency. Sole distributors in U.K.: Herzbi Limited.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week fell 28 tons to 6,136 tons, comprising London 2,970, Liverpool 1,875 and Hull 1,291.

Copper stocks rose 526 tons to 21,651, distributed as follows: London 700, Liverpool 16,901, Birmingham 50, Manchester 3,925, Hull 50 and Glasgow 25.

Lead duty-free stocks fell 1,250 tons to 7,661 tons, comprising London 7,386, Glasgow 100, Swansea 175. In-bond stocks rose 300 tons to 3,543 tons (all in London).

Zinc duty-free stocks fell 30 tons to 4,093, comprising London 3,079, Glasgow 201, Manchester 400, Liverpool 413. In-bond stocks fell 25 tons to 2,435 (all in London).

Change of Address

With effect from Monday next, the Manchester office of the **David Brown Corporation (Sales) Ltd.** will be located at Ashburton Road, Trafford Park, Manchester, 17, with the telephone number of Trafford Park 4751-2.

A New Device

Coil cut-up lines made by **Press Equipment Limited** are now available with a new electro-mechanical metering and measuring device, which supersedes the conventional end stop and retracting run-out track. This metering and measuring device operates in conjunction with the straightening unit of the line, detects the amount of material passing through the outgoing pinch rolls, and automatically stops the straightener and operates the shear when it has metered off the required length. It incorporates automatic re-set to provide instantaneous restart of the straightener and measure as the shear blades open.

Setting of length required is by two dials, one for feet and the other for inches, the former requiring only a coarse setting. Accuracy on lengths up to 12 in. is in the order of ±0·015 in., and, unlike end stop arrangements, does not deteriorate on longer lengths. The output side of the shear unit is left completely clear for a conveyor, or any take-off or stacking arrangements that the user may require.

Varnish Coatings

As a result of recent examination of the requirements of varnishes for production of resin-bonded molybdenum disulphide lubricating films on metals and other surfaces, **Rocol Limited** is continuing to market Rocol Molytox Plus as a general-purpose varnish, especially when ease of application is a factor to be considered, but is now also listing Rocol Molydite Plus, based on a thermosetting resin, as a bonding agent.

This new grade is said to give a tougher bonding but requires more care in application and baking at a comparatively high temperature of 200°C. (392°F.).

Refractory Coatings

Formerly manufactured and marketed by Corrosion Limited, "Furnascote" refractory coatings will in future be manufactured and marketed by **Furnascote Limited,** working from 16-18 Malvern Road, Southampton.

West German Production

Production of aluminium semi-manufactureds in West Germany is now running above the amount of orders being received, it is reported by trade sources. The number of orders being given has receded considerably since the boom period in the second half of last year, but there are still enough in hand to keep production at a high level, the sources added.

Production would suffer if more orders were not coming in shortly, but the industry is confident that consumers' stocks have gone down of late and that the situation would improve. Imports of semi-manufactureds into West Germany are rising, the sources added. After trebling last year to a total of 8,000 tons, they were now running at a monthly average of 900 tons, and for 1961 are expected to be higher by about 25 per cent over last year.

Autumn Lectures

A course of ten lectures on "Technology of Non-Ferrous Secondary Metals" is to be given at the **College of Advanced Technology, Birmingham** (Department of Metallurgy) on successive Wednesday evenings, commencing October 11, 1961. The course tutor is Mr. K. A. Reynolds, B.Sc., A.C.T.(Birm.), A.I.M.

Complete programmes of these lectures and registration forms may be obtained from the secretary of the National Association of Non-Ferrous Scrap Metal Merchants.

Indonesian Tin Smelting

Indonesia may be smelting tin for other countries in a few years' time, according to Colonel R. Pirngardie, President director of Government Mining Enterprises. At present, Indonesia refines its tin in Malaya and the United States. By having its own refinery, the Government would save hundreds of millions of U.S. dollars in foreign exchange, he said. Later, Indonesia might be able to refine tin for other countries.

As already announced, Indonesia will shortly start building a refinery on the tin-rich Java Sea island of Bangka. When completed, in two and a half years' time, it is expected to be capable of processing all the Republic's domestic tin requirements. In the meantime, Colonel Pirngardie added, the Government was also thinking of trying to produce "secondary tin" and "tin slag", which were, at present, fetching good prices on world markets.

Galvanizing Process

A process for galvanizing steel wire has been introduced to this country by **AEI-Birlec Limited.** Originally developed in France, this process is stated to offer certain economic and technical advantages over the usual sequence of annealing, pickling, fluxing and dipping.

The first Birlec plant to operate this process is at present under construction. It will handle approximately 1½ tons of wire per hour. Two similar installations have already been ordered for an overseas plant and it is expected that a large section of the wire industry may benefit from the process.

Accidents

In the first quarter of this present year 179 persons were fatally injured in factory and works, etc., accidents, and 48,282 were injured. Of these, 17 deaths and 6,560 injuries occurred in the metal processing industries.

These figures are given in the accident statistics contained in the quarterly journal "Accidents—How They Happen", published for the Ministry of Labour. Within its 36 pages the journal discusses various types of accidents which have been notified to H.M. Inspectors of Factories, and a number of illustrations are given showing how some of these were caused. One incident described is that of a foreman whose hand was trapped in a die-casting machine. Another deals with a worker who received an electric shock from welding tongs.

Copies of this booklet should be obtained and studied by all concerned. with the provision of safety requisites and accident prevention in factories, engineering workshops, etc. Published by H.M. Stationery Office, the price of the publication is 1s. 3d. net.

Licence Granted

A research licence has been granted to the Battelle Memorial Institute for the patented Ugine-Sejournet steel extrusion process, which uses molten glass as the extrusion lubricant. This process is licensed by Compagnie du Filage des Metaux et des Joints Curty to 34 companies throughout the world.

Under the terms of the licence, the Columbus, Ohio, research centre will use the process to conduct research for industry and government on various extrusion applications.

Nuclear Engineering Company

Three industrial concerns, **Imperial Chemical Industries Ltd.** (Metals Division), **Rolls-Royce Ltd.,** and **The Rio Tinto Co. Ltd.** have jointly formed a new company to operate in the field of civil nuclear engineering in collaboration with the atomic power consortia. The new

company is to be called Nuclear Developments Ltd., and the United Kingdom Atomic Energy Authority has been kept fully informed of its formation.

Each of the participants has, in addition to wide technical resources and skills, experience which will be appropriate to the future role of the new company in nuclear engineering. Rio Tinto mines, extracts and processes uranium on a large scale. Rolls-Royce has been engaged in the nuclear field for the past eight years and has a specific interest in marine nuclear propulsion. I.C.I. Metals Division has made several notable contributions to technological progress in nuclear engineering over the last twenty years and has exceptional facilities for the manufacture of nuclear metals and reactor components.

News from Birmingham

Quiet conditions prevail in the metal industries in the area owing to the holidays. Buying is at a standstill and activity is likely to be on a reduced scale during the next week or two. The news in regard to increased hire purchase charges, coming on top of the "Little Budget", has caused further apprehension in the motor trade. It is regarded as a deterrent to home sales. A spokesman said recently that the industry has always maintained that a sound and steady home market is necessary to success in overseas markets.

Metal rolling firms have good order books to ensure production when the works open next week. There is still heavy pressure for pressings and castings used in the engineering and building industries.

Makers of machine tools are reported to have a year's work on the order books. Export business is expected to expand. Pig iron output is adequate to cover the needs of the iron foundries in the area. Makers of heavy castings are well situated for work in the engineering industries. There is a good demand for heavy plates for boiler making. Stocks of iron and steel generally are high both in works and merchants' yards.

Belgian Aluminium Venture

It is reported from New York that Reynolds International Incorporated and Société Generale de Belgique have formed a company—Aluminium Europe—to build a plant in Belgium for aluminium product fabrication. Stock of the new company will be shared equally between the U.S. company and a Belgian group comprising Société Generale, Union Financiere et Industrielle Liegeoise, Société de Traction et d'Electricite, and Cobeal, in which Société Generale has interests.

Aluminium for New Zealand

Recently shipped from New Orleans, U.S.A., to New Zealand was the first consignment of aluminium billet developed and manufactured by **Kaiser Aluminum and Chemical Corporation** especially for extrusion production. When the billets arrive at New Plymouth, New Zealand, **McKechnie Brothers Limited,** one of the largest aluminium extruders in New Zealand, will use them for a variety of components.

Machine Tool Exhibits

At the forthcoming European Machine Tool Exhibition, to be held in Brussels next September, **B. O. Morris Ltd.** will be exhibiting a number of their products, including tungsten carbide burrs, the Scully-Jones toolholders, the Clairpool 303 automatic sheet polishing machines, and an abrasive band machine.

One of the varied range of autopolishing machines produced by the Morrisflex - Hammond division is the CFT.40 automatic polishing machine, which consists of a worktable incorporating a sprocket and pressure roll projecting through the table face.

Then there is the 12 in. cut and deburr machine, produced by the Wallace division of Morrisflex, which is a mobile abrasive cutting-off machine for bars, tubes, channels, angles, etc., incorporating a large, power-driven, rotary wire brush for quickly deburring the ends of the cut pieces.

Shaker Hearth Furnaces

An order for two shaker hearth furnaces has been received by the **Incandescent Heat Company Ltd** from Cooper and Turner Ltd., of Sheffield. One will be used for normalizing rivets and the other will be used for hardening bolts that are direct quenched from the shaker hearth. Both of these furnaces are gas-oil fired using the new R.I.M.P.A. high duty burners.

For Sealing Work

A new all-purpose mastic, said to be suitable for all general sealing work, has been developed by **Evomastics Ltd.,** a subsidiary company of Evode Ltd., and is now available in collapsible tube form. This mastic forms a tough flexible skin around any part of the compound exposed to air. Should movement be beyond the normal stretch properties of the surface skin, it will break and reseal without breaking away from the edges or body of the joint.

Dust Measuring Equipment

At the forthcoming Clean Air Exhibition, to be held at Brighton in October this year, **Associated Electrical Industries Ltd.** will demonstrate their dust measuring equipment for power stations and processes. This equipment has been designed to accurately record the density of smoke discharged through a duct or chimney.

LIGHT METALS STATISTICS IN JAPAN
(March 1961)

Classification	Production	Shipment	Stock	Export
Alumina	34,619	40,908	14,058	17,297
Super purity Al	107	100	696	0
Primary Al	11,777	12,561	3,935	**0**
Secondary Al	5,932	5,811	1,127	**0**
Wrought products (Al and its alloy)	14,267	14,427	3,834	904
Plate, sheet and strip	9,082	8,895	2,708	
Foil	1,029	1,070	299	
Rolled and extruded shape	2,282	2,422	298	798
Forgings	46	—	—	—
Electric wire	1,828	2,040	529	106
Powder, flake and paste	—	—	—	—
Casting	6,546	—	—	—
Sand and permanent mould	3,455	—	—	—
Die	3,091	—	—	—
Sheet products	2,828	2,917	1,131	110
Primary Mg	124	193	75	—
Secondary Mg	239	262	385	—
Mg casting	42	—	—	—
Sponge Ti	195	238	1,021	218
Super purity Al (April)	83	83	696	—
Primary Al (April)	12,008	13,491	2,452	**0**

Vacuum Science and Technology

An announcement from the Institute of Physics and the Physical Society states that it is intended to hold a one-day Symposium on "Some Aspects of Vacuum Science and Technology" at the Imperial College of Science and Technology in London on January 5 next year.

The scope of the Symposium will be: (a) continuously exhausted bakeable vacuum apparatus for pressures below 10^{-9} mm. of mercury and (b) the controlled deposition of evaporated film.

Anode and Plating Bulletin

A two-colour, eight-page bulletin illustrating and describing the full line of their anodes, anode accessories and chemicals for electroplating and metal finishing has just been made available by the **Hanson-Van Winkle - Munning Company**, of Matawan, New Jersey.

Nickel, cadmium, brass and bronze, copper, lead and zinc anodes are described and illustrated. Various types of nickel anodes are listed, along with recommended applications and *p*H ranges. One full page of drawings gives instructions on how to order hooks for round, flat and shaped lead anodes.

Descriptions and recommended applications are given for several styles of H-VW-M laboratory checked anode bags. Instructions on how to order regular anode hooks are also given. Titanium anode baskets are a latest addition and provide for complete use of nickel scrap metal or electrolytic nickel squares. Recommendations and sizes are in the bulletin.

Safety in Industry

A safety code for workers exposed to ionizing radiations in industry is laid down in the Ionising Radiations (Sealed Sources) Regulations, 1961, made by the Minister of Labour, Mr. John Hare, and presented to Parliament on Thursday of last week. Most of the requirements will come into operation in six months' time, but those requiring the notification of the use and disuse of ionizing radiations in factories will be effective from Tuesday next, August 15.

The regulations impose requirements for safeguarding the health and safety of persons employed in factories and other places to which the Factories Acts apply, who may be exposed to ionizing radiations from sealed radioactive substances, and from certain machines, such as X-ray apparatus. They require the restriction of the exposure of workers to such radiations, the adequate shielding of sources of ionizing radiations and instructions for workers likely to be exposed to them about the hazards involved and the precautions to be taken.

Maximum permissible doses of radiation are laid down, and the regulations include requirements for the medical supervision of workers, and for the wearing of film badges to measure personal doses received.

The regulations have been drawn up in the light of numerous observations received after the publication of two preliminary drafts and two statutory drafts, and of consultations with organizations of employers, workers and other interested parties. They were also considered by an *ad hoc* expert committee appointed to advise the Chief Inspector of Factories on the subject, by the Advisory Panel on Radiological Problems in Industry and by

the General Purposes Committee of the Radioactive Substances Advisory Committee.

Processing Machinery

For many years builders of machinery and plant for the plastic shaping of ferrous and non-ferrous metals, **Schloemann Aktiengesellschaft** have now extended their traditional production programme by entering the field of plastics processing plant, and now supply twin screw extruders and injection moulding machines.

The heavy duty injection moulding machines, which were developed in conjunction with Albert Stuvve, Vlotho an der Weser, have shot capacities up to 13¼ lb. The twin screw extruders are mainly employed for the production of tubes and sections, and it is understood that a special feature of these machines is that, when processing rigid PVC, powder can be used as the starting material.

Australian Protective Duties

Recent news from Canberra is that the Trade Minister, Mr. John McEwen, has announced that Australia was imposing immediately temporary protective duties on imports of thin copper and brass sheet and strip.

The duties—which are additional to the normal duties—will be at rates of 12½ per cent on copper sheets and strip, and 10 per cent on brass sheet and strip. The duties will not apply to goods in transit to Australia before June 28. The imposition of the temporary duties follows recommendations by the deputy chairman of the Tariff Board, who had reported that urgent action was necessary to protect local industries against imports.

Aluminium in West Germany

At a Press conference in Düsseldorf, Dr. Karl Roehr, a member of the board of Vereinigte Aluminium-Werke A.G. (VAW), one of West Germany's largest aluminium firms, said that the country's aluminium stocks of 50,000 tons at the end of 1960, had declined by about 20,000 tons at the end of June. West German aluminium production, he indicated, was not keeping step with rising consumption.

Dr. Roehr supplied the following statistics (in 1,000 tons) for the first half of this year: pig aluminium output, 85; secondary aluminium output, 69; aluminium semi-manufacturers' output, 121; precast aluminium output, 63; pig aluminium imports, about 80.

Malayan Tin Shipments

The Straits Trading Company reports that tin shipments from Penang in July totalled 5,924¼ tons against 6,797¼ tons in June. July shipments comprised 60 tons to the U.K., 2,931 to the U.S.A., 808 to the Continent, 325 to Canada, 1,117 to Japan, 44½ to the Pacific, 359¼ to India, 181½ to South America, five to Africa, 75 to Australasia and 17¾ to the Middle East.

Shipments from Singapore in July totalled 495 tons, against 646 tons in June, comprising 50 tons to the United States, 424½ to the Continent, 20 to Africa, a quarter of a ton to the Pacific and half a ton to India.

World Tin Statistics

World mine production of tin-in-concentrates in April totalled 12,900 tons against 12,800 tons in March, according to the July issue of the International Tin Council's monthly statistical bulletin. World smelter production of tin metal in April was 14,600 tons against 13,500 tons in March. World consumption of primary tin metal was 15,200 tons against 15,800 tons in March.

Stocks of tin-in-concentrates in Malaya and Singapore at the end of April totalled 4,551 tons compared with 6,834 tons at end-March. Stocks of tin-in-concentrates in Nigerian mines and at smelters in the U.K. and Belgium were also lower at end-April: stocks at smelters in the two latter countries declined further in May. Stocks in Bolivia and Thailand, on the other hand, were higher at the end of April.

Atomic Physics Conference

Manchester University is to be the venue of the Rutherford Jubilee International Conference, which will be held from September 4 to 8 this year. This event will mark the fiftieth anniversary of the discovery of the atomic nucleus by Rutherford and his collaborators in Manchester in 1911. Some 400 leading research workers from various countries will attend the function, and 16 major Papers will be presented.

On September 5, Sir Ernest Marsden will preside at a commemorative session, "Rutherford of Manchester", and the conference will be followed by a symposium on instruments of nuclear physics at the Atomic Energy Research Establishment at Harwell, from September 11 to 12.

Indian Aluminium Plans

Recent news from Bhopal states that the Madhya Pradesh Government is actively considering ways and means for establishing aluminium plants to enable full and proper exploitation of high grade bauxite deposits plentifully available in the state. A team of Hungarian experts, which will shortly be arriving in India to advise the Government of India on the establishment of a public sector aluminium plant, will visit Amarkantak region in Madhya Pradesh to examine the possibilities of locating the proposed plant there.

The hilly region of Amarkantak is said to contain the richest sort of bauxite deposits. Deposits have also been located in the Balaghat, Bilaspur, Surguja, Raigarh and Seoni districts. In addition, low grade coal for power generation is also stated to be available in abundance around Amarkantak. A 60,000 kW thermal station is already under construction there. Meanwhile, the state government is reported to have received offers from some leading industrialists for establishing aluminium plants in the state in the private sector.

Trade Publications

Ultra Pure Elements.—L. Light and Company Limited, Poyle Estate, Colnbrook, Bucks.

This new catalogue lists materials of interest to research workers in the nuclear and electronics industries. Among the items listed are semiconductor, thermoelectric and other high purity compounds, single crystals, rare earth metals and salts.

X-ray Equipment. — Pantak Limited, Vale Road, Windsor, Berks.

In a new illustrated brochure describing their range of mobile constant potential X-ray units this company gives full details of control units, generators, tube shields, tubes and cooling systems together with details of mountings. A feature of these X-ray machines is the use of a double Greinacher circuit using metal rectifiers to supply a rectified constant potential voltage to the X-ray tube.

Copper Roofing. — The Ruberoid Company Limited, 1-19 New Oxford Street, London, W.C.1.

A triple folder contains full details of Ruberoid copper roofing with a number of diagrams and illustrations. This roofing material is manufactured from 42 gauge copper sheet with spherical indentations and with a backing of filled bitumen, in rolls of 18 yd. by approximately 2 ft.

New Companies

T. Duke and Co. (Polishers) Limited (695818), 120 Birdbrook Road, Great Barr, Birmingham, 22a. Registered June 16, 1961. To carry on business of platers, polishers, bronzers, etc. Nominal capital, £300 in £1 shares. Director: Thomas Duke.

BEC Construction Co. Ltd. (696211), 33 East Hill, Wandsworth, S.W.18. Registered June 21, 1961. To carry on the business of dealers, merchants and workers in metals and minerals, steel and glass partitioning, etc. Nominal capital, £1,000 in £1 shares. Directors: Reginald A. Prentice and Warren P. James.

Delta Enfield Rolled Metals Limited (696763). Registered June 28, 1961. To take over the businesses of manufacturers and marketers of rolled copper and brass and bronze sheet and strip and shapes cut from sheet and strip carried on by (1) Earle Bourne and Co. Ltd., (2) Alfred Case and Co. Ltd., and (3) Enfield Rolling Mills Ltd. Nominal capital £2,700,000 in £1 shares (1,350,000 "A", 1,350,000 "B"). Directors not named.

R. Rundle and Son Limited (696651), 52a Town Lane, Idle, Bradford. Registered June 27, 1961. To carry on the business of architectural metal workers and designers, iron and brass founders, etc. Nominal capital, £500 in £1 shares. Arthur R. Hunter signs as director.

Aldridge Rolling Mills Limited (696724), 8 George Road, Edgbaston, Birmingham, 15. Registered June 28, 1961. Nominal capital, £500 in £1 shares. Directors: David Gerzon and Gertrude Gerzon.

F. C. Larkinson (Far Cotton) Limited (696733), 18 St. George Street, W.1. Registered June 28, 1961. To carry on the business of scrap metal merchants, etc. Nominal capital, £100 in £1 shares. Director: Sigmund Sternberg.

Ferrous and Non-Ferrous Limited (696766), Albion Mill, Acre Street, Hollinwood, nr. Oldham. Registered June 28, 1961. To carry on the business of wholesale and retail dealers, workers in ferrous and non-ferrous metals, and minerals, etc. Nominal capital, £100 in £1 shares. Directors: Mrs. Kathleen N. Silver, Jack Sherman and Alan J. Wright.

Metal Market News

TIN was the only metal to register an advance in the pre-holiday trading week and that gain was confined to a couple of pounds in the cash position. As to the others, minor fluctuations took place, but on balance lower levels than a week earlier were reached, although losses were not very serious. Zinc, however, made rather a poor showing, and there appears to be little or no enthusiasm for this metal in which supplies seem to be ample. This cannot altogether be confirmed for lead for it appears that as a result of the conference at Mexico City earlier in the year production has been reduced, in consequence of which the amount of metal coming forward is definitely less. It is understood that some supplies of Commonwealth lead are rationed. Be this as it may, there is a tendency to take a somewhat bullish view of the prospects for this metal, and if stocks are any indication then it should be noted that at the beginning of last week L.M.E. reserves in warehouse were reported 825 tons lower at 12,154 tons, this fall being a long way ahead of reductions in the other metals.

As to the other metals, there was an increase in the stocks of copper from 20,852 tons to 21,125 tons, and the market closed with a contango of £3 15s. 0d., or 5s. more than a week earlier. The downward slide in tin stocks continued last week, with news that stocks in official warehouses had dropped by a further 91 tons to 6,164 tons. There was also a fall in warehouse stocks of zinc from 6,685 tons to 6,583 tons. On the whole, trading was fairly active considering the proximity of the holidays, and in 4½ days trading rather more than 14,000 tons of copper changed hands, without Kerb trading, which was probably on quite a good scale. A loss of £1 10s. 0d. was registered in cash, which closed at £229 15s. 0d., while three months, at £233 10s. 0d., was 25s. down.

The low point for copper was £228 15s. 0d. cash and £232 5s. 0d. forward on Thursday, and throughout the week values fluctuated in line with the confusing reports about the strike position at Potrerillos and El Salvador. As we write, the men are at work at these mines and, on the whole, it looks as though a strike will be avoided. Consumer demand for copper was reported to be rather poor. In tin, about 1,360 tons changed hands, cash gaining £2 to £925, while three months was unaltered at £935. Cash lead dropped 7s. 6d. and three months 2s. 6d. to £64 15s. 0d. and £66 2s. 6d. on a turnover of 7,500 tons. Zinc closed 15s. down for cash at £77 10s. 0d., while three months lost 22s. 6d. at £78 2s. 6d. Some 6,500 tons changed hands.

New York

Copper futures were firmer at the week-end on covering in advance of the bank holiday in Britain. Dealings were thin. In physical copper, dealers noted quiet conditions. Producers and custom smelters indicated an unchanged satisfactory sales situation. Tin was steadier and quiet, helped by the advance abroad. Lead and zinc sales were termed fair. In the closing stage, tin was quiet, with a softer undertone. Scrap copper was steady and quiet.

It is reported from Washington that the House Interior Subcommittee on Mines and Mining has favourably reported to the full Interior Committee on a Bill to subsidize small U.S. producers of lead and zinc. The Subcommittee amended the Bill considerably before finally approving it. As originally drafted, the Bill proposed a combined payment to producers on production of 2,000 tons of lead and 2,000 tons of zinc annually—for a total output of 4,000 tons — at a combined price for the two metals of 31½ cents—17 cents per lb. for lead and 14½ cents per lb. for zinc—over a period of five years.

A Committee spokesman said that, as amended, the Bill would provide for a combined payment to producers of 29 cents—14½ cents each for both lead and zinc—over a period of four years. A producer would receive subsidy payments in the first year of operation of the programme on a total output of 3,000 tons — 1,500 tons of lead and 1,500 tons of zinc; in the second year, payments on production of 1,200 tons of lead and 1,200 tons of zinc; in the third year, payments on 900 tons of lead and 900 tons of zinc; and in the fourth and last year, payments on 600 tons of lead and 600 tons of zinc.

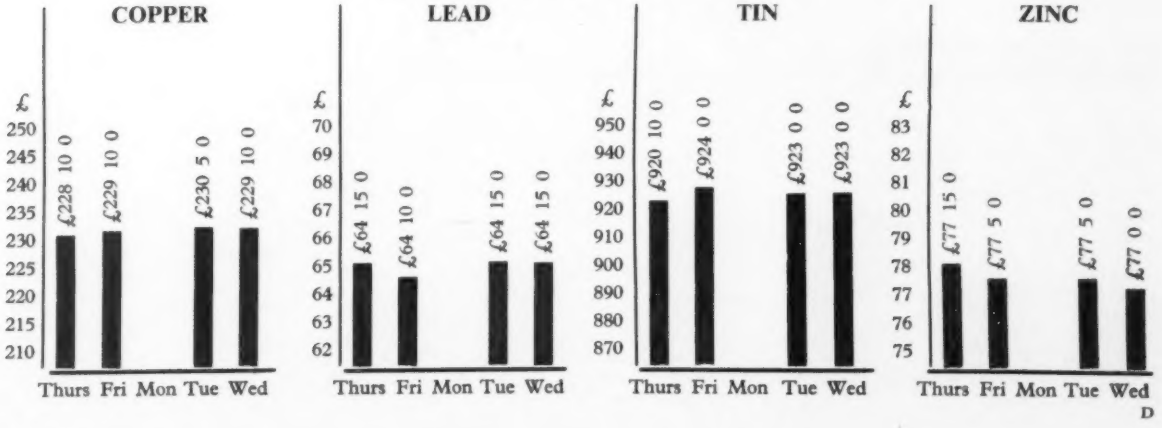
The base period established for producers to be eligible for payments in the amended Bill would be for the period from January 1, 1956, to the first day of the period for which a producer applied to the Interior Department for subsidies. The amended Bill also would limit payment of subsidies to a total of $4,500,000 on both lead and zinc in the first and second years.

Zurich

Business on the Swiss non-ferrous metals market during July was substantially reduced, reflecting holiday influences. Demand for copper was active, however, largely owing to its lower price level. A revival of business is expected for the autumn. Trade quarters assume that in view of the boom, Swiss metal consumption is large and that after holidays users will not only buy current requirements but also increase their stocks. Copper was appreciably cheaper during July, but zinc and tin prices showed little change, with lead and nickel unchanged.

London Metal Exchange

Thursday 3 August to Wednesday 9 August 1961



D

NON-FERROUS

PRIMARY METALS

All prices quoted are those available at 2 p.m. 9/8/61

		£	s.	d.
Aluminium Ingots	ton	186	0	0
Antimony 99·6%	„	237	10	0
Antimony Metal 99%	„	230	0	0
Antimony Oxide Commercial	„	194	10	0
Antimony White Oxide	„	212	0	0
Arsenic	„	400	0	0
Bismuth 99·95%	lb.		16	0
Cadmium 99·9%	„		11	0
Calcium	„	2	0	0
Cerium 99%	„	15	0	0
Chromium	„		6	11
Cobalt	„		12	0
Columbite per unit			8	10	0
Copper H.C. Electro	ton	229	10	0
Fire Refined 99·70%	„	228	0	0
Fire Refined 99·50%	„	227	0	0

		£	s.	d.
Copper Sulphate	ton	78	0	0
Germanium	grm.		—	
Gold	oz.	12	12	2½
Indium	„		10	0
Iridium	„	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	64	15	0
Magnesium Ingots	lb.			
99·8%	„		2	2½
99·9+%	„		2	3
Notched Bar	„		2	9½
Powder Grade 4	„		5	6
Alloy Ingot, AZ91X		1	11¾-2	1¼
Manganese Metal	ton	280	0	0
Mercury	flask	65	0	0
Molybdenum	lb.	1	15	0
Nickel	ton	660	0	0
F. Shot	lb.		5	11
F. Ingot	„		5	11
Osmium	oz.	20	0	0
Osmiridium	„		—	

		£	s.	d.
Palladium	oz.	9	0	0
Platinum	„	30	5	0
Rhodium	„	46	0	0
Ruthenium	„	16	0	0
Selenium	lb.	2	6	6
Silicon 98%	ton	123	0	0
Silver Spot Bars	oz.		6	7⅛
Tellurium Sticks	lb.	2	0	0
Tin	ton	923	0	0
***Zinc**				
Electrolytic	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	77	8	9
Dust 95/97%	„	121	10	0
Dust 98/99%	„	128	10	0
Granulated 99+%	„	102	8	9
Granulated 99·99+%	„	114	18	9

**Duty and Carriage to customers' works for buyers' account.*

INGOT METALS

All prices quoted are those available at 2 p.m. 9/8/61

Aluminium Alloy (Virgin)		£	s.	d.
B.S. 1490 L.M.5	ton	210	0	0
B.S. 1490 L.M.6	„	202	0	0
B.S. 1490 L.M.7	„	216	0	0
B.S. 1490 L.M.8	„	203	0	0
B.S. 1490 L.M.9	„	203	0	0
B.S. 1490 L.M.10	„	221	0	0
B.S. 1490 L.M.11	„	215	0	0
B.S. 1490 L.M.12	„	223	0	0
B.S. 1490 L.M.13	„	216	0	0
B.S. 1490 L.M.14	„	224	0	0
B.S. 1490 L.M.15	„	210	0	0
B.S. 1490 L.M.16	„	206	0	0
B.S. 1490 L.M.18	„	203	0	0
B.S. 1490 L.M.22	„	210	0	0
Aluminium Alloys (Secondary)				
B.S. 1490 L.M.1	ton	155	0	0
B.S. 1490 L.M.2	„	153	0	0
B.S. 1490 L.M.4	„	163	0	0
B.S. 1490 L.M.6	„	176	0	0
***Aluminium Bronze**				
BSS 1400 AB.1	ton	243	0	0
BSS 1400 AB.2	„	251	0	0

		£	s.	d.
***Brass**				
BSS 1400-B3 65/35	ton	177	0	0
BSS 249	„		—	
BSS 1400-B6 85/15	„	224	0	0
***Gunmetal**				
R.C.H. 3/4% ton	„		—	
(85/5/5/5) LG2	„	219	0	0
(86/7/5/2) LG3	„	229	0	0
(88/10/2/1)	„	288	0	0
(88/10/2/½)	„	298	0	0
***Manganese Bronze**				
BSS 1400 HTB1	„	194	0	0
BSS 1400 HTB2	„	215	0	0
BSS 1400 HTB3	„	230	0	0
Nickel Silver				
Casting Quality 12%	„	260	0	0
„ „ 16%	„	270	0	0
„ „ 18%	„	310	0	0
***Phosphor Bronze**				
B.S.1400P.B.1.(A.I.D. released)	„	315	0	0
B.S. 1400 L.P.B.1	„	242	0	0

**Average prices for the last week-end.*

Phosphor Copper		£	s.	d.
10%	ton	257	0	0
15%	„	260	0	0
Phosphor Tin				
5%	„	999	0	0
Silicon Bronze				
BSS 1400-SB1	„	290	0	0
Solder, soft, BSS 219				
Grade C Tinmans	„	416	0	0
Grade D Plumbers	„	330	5	0
Grade M	„	459	0	0
Solder, Brazing, BSS 1845				
Type 8 (Granulated)	lb.		—	
Type 9 „	„		—	
Zinc Alloys				
BSS 1004 Alloy A	ton	108	8	9
BSS 1004 Alloy B	„	112	8	9
Sodium-Zinc	lb.		2	6½

SCRAP METALS

Merchants' average buying prices delivered, per ton, 8/8/61

Aluminium	£
New Cuttings	139
Old Rolled	104
Segregated Turnings	78
Brass	
Cuttings	162
Rod Ends	147
Heavy Yellow	139
Light	134
Rolled	149
Collected Scrap	136
Turnings	140

Copper	£
Wire	210
Firebox, cut up	208
Heavy	207
Light	204
Cuttings	215
Turnings	190
Braziery	171
Gunmetal	
Gear Wheels	200
Admiralty	200
Commercial	182
Turnings	177

Lead	£
Scrap	54
Nickel	
Cuttings	—
Anodes	591
Phosphor Bronze	
Scrap	182
Turnings	177
Zinc	
Remelted	70
Cuttings	60
Old Zinc	40

METAL PRICES

SEMI-FABRICATED PRODUCTS

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products

	£ s. d.
Aluminium	
Sheet 10 S.W.G. lb.	2 10½
Sheet 18 S.W.G. „	3 0½
Sheet 24 S.W.G. „	3 3½
Strip 10 S.W.G. „	2 10½
Strip 18 S.W.G. „	2 11½
Strip 24 S.W.G. „	3 1
Circles 22 S.W.G. „	3 4½
Circles 18 S.W.G. „	3 3½
Circles 12 S.W.G. „	3 2½
Plate as rolled „	2 10
Sections „	3 4
Wire 10 S.W.G. „	3 1½
Tubes 1 in. o.d. 16 S.W.G. „	4 4
Aluminium Alloys	
BS 1470. HS19W.	
Sheet 10 S.W.G. „	3 3
Sheet 18 S.W.G. „	3 5½
Sheet 24 S.W.G. „	4 1
Strip 10 S.W.G. „	3 3
Strip 18 S.W.G. „	3 4½
Strip 24 S.W.G. „	4 0½
BS1477. HP30M. Plate as rolled „	3 1
BS1470. HC15WP.	
Sheet 10 S.W.G. „	4 3
Sheet 18 S.W.G. „	4 8½
Sheet 24 S.W.G. „	5 8½
Strip 10 S.W.G. „	4 4
Strip 18 S.W.G. „	4 8½
Strip 24 S.W.G. „	5 4½

	£ s. d.
Aluminium Alloys—cont.	
BS1477. HPC15WP. Plate heat treated .... lb.	3 10½
BS1475. HG19W. Wire 10 S.W.G. „	4 2
BS1471. HT19WP. Tubes 1 in. o.d. 16 S.W.G. „	5 5
BS1476. HE19WP. Sections „	3 4
Split tube	
19 S.W.G. (⅛″) „	4 2
20 S.W.G. (⅛″) „	3 11
21 S.W.G. (⅛″) „	4 1
22 S.W.G. (¼″) „	4 11
Welded tube (sizes ½″ to 1½″) „	3/10½ to 5/8½
Brass	
Tubes lb.	1 9⅛
Brazed Tubes „	3 3⅛
Drawn Strip Sections „	3 3⅛
Sheet ton	198 15 0
Strip „	198 15 0
Extruded Bar lb.	2 0⅜
Condenser Plate (Yellow Metal) ton	186 0 0
Condenser Plate (Naval Brass) „	199 0 0
Wire lb.	2 8½

	£ s. d.
Beryllium Copper	
Strip lb.	1 4 11
Rod „	1 1 6
Wire „	1 4 9
Copper	
Tubes lb.	2 3⅜
Sheet ton	265 5 0
Strip „	265 5 0
H.C. Wire „	282 15 0
Cupro Nickel	
Tubes 70/30 lb.	3 9
Lead	
Pipes (London) ton	107 0 0
Sheet (London) „	104 15 0
Tellurium Lead „	£6 extra
Nickel Silver	
Sheet and Strip 10% lb.	3 11½
Wire 10% „	4 4½
Phosphor Bronze	
Wire „	4 2
Titanium (1,000 lb. lots)	
Billet 4½″ to 18″ dia. lb.	47/- 48/-
Rod ¼″ to 4″ dia. „	85/- 53/-
Wire ·036″-232″ dia. „	159/- 99/-
Strip ·001″ to ·048″ „	350/- 68/-
Sheet 8′ × 2′. 20 gauge „	73/-
Tube, representative average gauge „	198/-
Extrusions „	90/-
Zinc	
Sheet ton	115 5 0
Strip „	nom.

FOREIGN QUOTATIONS

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

Belgium	fr/kg	£/ton
Copper: electrolytic	31.75	232 1
Tin	128.10	936 5

Canada	c/lb	£/ton
Aluminium	26.00	210 12
Copper: electrolytic	30.00	243 0
Lead	10.50	81 0
Nickel	70.00	567 0
Zinc: Prime western	12.00	97 4
High grade 99.95	12.60	102 1
High grade 99.99	13.00	105 6

France	fr/kg	£/ton
Aluminium	2.43	179 11
Antimony 99·0	2.80	206 18
Cadmium	16.35	1,208 5
Copper: electrolytic	3.19	235 14
Lead	.95	70 4
Nickel	9.00	665 2
Tin	13.05	964 7½
Zinc: Thermic	1.14	84 4
Zinc: electrolytic	1.22	90 3
Scrap		
Copper: electrolytic	2.85	210 12
Heavy copper	2.85	210 12
No. 1 copper wire	2.70	199 10
Brass rod ends	2.10	155 3
Zinc castings	.90	66 10
Lead	.87	64 5
Aluminium	1.75	129 6

Italy	lire/kg	£/ton
Aluminium	370	216 1
Antimony 99·0	485	283 4
Copper: wire bars 99.9	450	262 16
Lead	164	96 15
Nickel	1,300	805 14
Tin	1,750	1,022 0
Zinc: electrolytic	180	105 2
Scrap		
Aluminium soft sheet clippings (new)	305	178 2
Lead, soft, first quality	137	80 0
Lead, battery plates	77	45 19
Copper, first grade	375	219 0
Bronze, commercial gunmetal	410	239 8
Brass: heavy	275	160 12
Brass: light	260	152 16
Brass, bar turnings	275	160 12
Old zinc	105	61 6

Switzerland	fr/kg	£/ton
Aluminium	2.50	210 5
Copper: electrolytic	2.90	243 17
Lead	.80	67 5
Nickel	7.50	630 15
Tin	11.20	942 0
Zinc: High grade 99.99	1.04	87 10

Japan	Yen per metric ton
Scrap	
Copper: electrolytic	298,000
Copper wire No. 1	272,000
Copper wire No. 2	268,000
Heavy copper	262,000
Light copper	237,000
Brass, new cuttings	203,000
Red brass scrap	215,000

West Germany *Scrap*	D-marks per 100 kilos	£/ton
Used copper wire	225	205 0
Heavy copper	220	200 8
Light copper	190	173 1
Heavy brass	145	132 1
Light brass	110	100 5
Soft lead	50	45 11
Zinc	50	45 11
Used aluminium unsorted	75	68 6

United States	c/lb	£/ton
Aluminium	26.00	207 4
Antimony 99·0	32.50	259 0
Cadmium	160.00	1,275 4
Copper: electrolytic	31.00	247 10
Lead	11.00	87 13
Nickel	81.25	647 11
Tin	117.00	932 10
Zinc: electrolytic	12.50	99 12

THE STOCK EXCHANGE

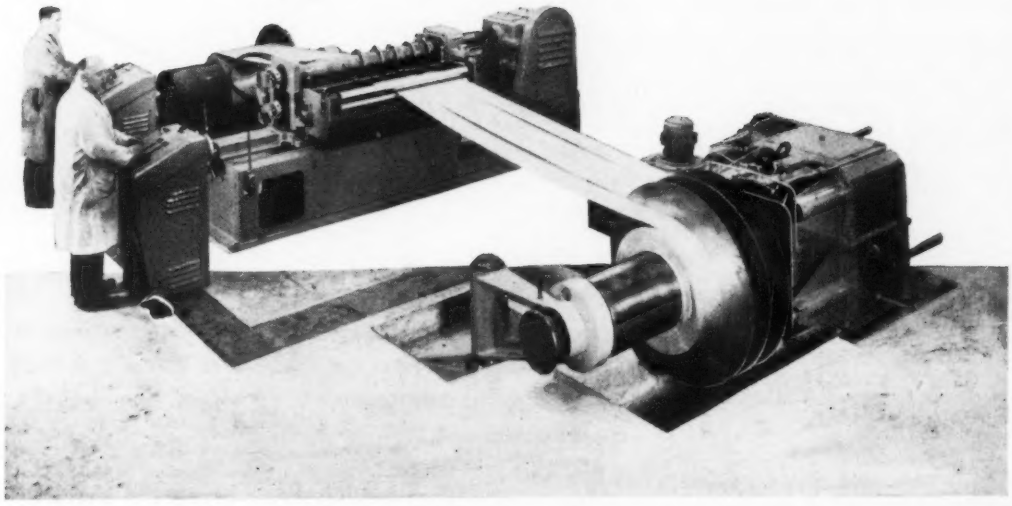
Prices recovered and trading increased

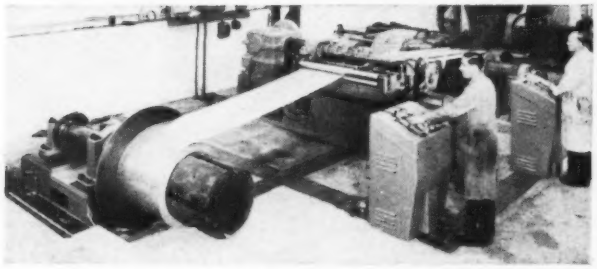
ISSUED CAPITAL •	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 4 AUG.	+RISE—FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1961 HIGH	1961 LOW	1960 HIGH	1960 LOW
£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	31/–		11	9	7 1 9	33/9	26/3	35/–	26/6
400,000	2/–	Anti-Attrition Metal	1/3		NIL	4	NIL	1/3⅜	0/9	1/6	0/9
43,133,593	Stk. (£1)	Associated Electrical Industries ...	37/–	+1/3	15	15	8 2 3	54/10½	35/9	67/3	38/3
3,895,963	1	Birfield	65/6	+3/6	10	15‡	3 1 0	78/9	45/–	51/3	29/–
4,795,000	1	Birmid Industries	79/–	+4/–	20	20D	5 1 3	103/–	71/3	74/9	56/–
8,445,516	Stk. (10/–)	Birmingham Small Arms	22/6	+1/6	17½QT	12½	5 6 6	36/10½	20/6	30/6	18/3
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	14/–		5	5	7 2 9	14/6	13/1½	17/4½	14/9
476,420	Stk. (£1)	Ditto Cum. B. Pref. 6%	16/6		6	6	7 5 6	17/6	16/1½	20/–	17/1½
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6% ...	15/9		6	6	7 12 6	18/–	15/3	21/1½	17/7½
18,846,647	Stk. (£1)	British Insulated Callender's Cables	59/–	+3/6	13½	13½	4 11 6	62/3	49/–	61/4½	47/–
20,456,599	5/–	British Oxygen Co. Ltd., Ord. ...	20/3	+9d.	16D	16	2 12 9	28/4½	17/6	35/–	19/10½
1,200,000	Stk. (5/–)	Canning (W.) & Co.	16/–	+6d.	15⅝	25+•2½C‡	4 19 0	20/9	13/7½	19/9	13/7½
60,484	1/–	Carr (Chas.)	1/1½	+1½d.	NIL	12½	—	1/7½	10½d.	2/3	1/–
555,000	1	Clifford (Chas.) Ltd.	30/–		12	10	8 0 0	31/–	26/–	35/–	28/9
45,000	1	Ditto Cum. Pref. 6%	15/–		6	6	8 0 0	15/3	15/–	16/–	15/10½
300,000	2/–	Coley Metals	3/3		15	15	9 4 6	4/5½	3/–	5/–	3/4½
10,185,696	1	Cons. Zinc Corp.†	73/9	+5/–	20	15	5 8 6	81/6	63/–	80/9	59/6
5,399,056	1	Davy-Ashmore	150/–	+7/6	27½	22½	3 13 3	177/6	129/6	147/3	99/6
8,000,000	5/–	Delta Metal	22/6	+1/6	20	17½	4 9 0	27/7½	19/9	28/3	18/6
5,296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	41/6	+1/–	15	15	7 4 6	52/3	39/–	56/9	45/–
1,155,000	1	Evered & Co.	43/6	—6d.	10	10φB	4 12 0	45/9	42/6	42/9	29/3
18,000,000	Stk. (£1)	General Electric Co.	31/6	+2/–	10	10	6 7 0	39/6	29/–	47/9	29/–
1,500,000	Stk. (10/–)	General Refractories Ltd.	60/–	+5/–	25	20	4 5 0	65/–	42/9	52/6	40/–
937,500	5/–	Glacier Metal Co. Ltd.	18/6	+6d.	15	13	4 1 0	21/1½	13/9	16/1½	11/1½
2,500,000	5/–	Glynwed Tubes	25/–	+6d.	22½	25¶	4 10 0	30/3	23/–	27/6	17/–
7,228,065	10/–	Goodlass Wall & Lead Industries ...	35/–	+1/9	15	19L	4 5 9	44/9	32/6	41/9	33/–
696,780	10/–	Greenwood & Batley	20/–		15	30‡	7 10 0	29/6	20/–	33/6	29/1½
792,000	5/–	Harrison (B'ham) Ord.	10/6		•10	•20‡	4 15 3	14/6	10/6	15/10½	11/9
150,000	1	Ditto Cum. Pref. 7%	19/9		7	7	7 1 9	20/4½	19/7½	23/6	22/–
1,612,750	5/–	Heenan Group	13/3	+1/3	13	15	4 18 0	17/1½	10/6	13/–	9/10½
251,689,407	Stk. (£1)	Imperial Chemical Industries ...	73/6	+5/6	13½	11½	3 14 9	81/6	63/1½	76/6	54/–
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	14/4½	+3d.	5	5	6 19 3	16/–	13/10½	18/–	15/4½
29,196,118	••	International Nickel	160	+5	$1.60	$1.50	1 14 0	160	104	105	84½
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	14/–		5	5	7 2 9	14/10½	13/6	16/6	14/6
6,000,000	1	Ditto Ord.	72/6	+1/6	15	12	4 6 3	75/–	57/6	67/6	44/9
600,000	10/–	Keith, Blackman	17/6	—1/–	17½	17½E	10 0 0	21/6	17/6	32/6	17/6
320,000	4/–	London Aluminium	12/3		13	12	4 5 0	15/–	8/6	12/6	7/10½
765,012	1	McKechnie Bros. Ord.	40/6xcap		12½K	17½F	6 3 6	53/6	35/4	71/6	57/3
1,530,024	1	Ditto A. Ord.	37/3xcap		12½K	17½F	6 14 3	53/3	35/3	69/3	55/–
1,108,268	5/–	Manganese Bronze & Brass	13/6		20⅝	20⅝	7 14 3	18/6	13/–	18/6	13/4½
50,628	6/–	Ditto (7½% N.C. Pref.)	5/6		7½	7½	8 3 6	6/–	5/–	6/6	5/9
26,361,444	Stk. (£1)	Metal Box	90/–	+5/–	12	12M	2 13 3	100/9	68/3	84/3	61/–
415,760	Stk. (2/–)	Metal Traders	7/6		50	50	13 6 9	8/9	6/9	10/9	7/1½
160,000	1	Mint (The) Birmingham	34/–		15 G	12½	5 17 9	35/9	24/–	39/–	33/6
80,000	5	Ditto Pref. 6%	72/–		6	6	8 6 9	77/6	72/–	80/–	75/–
5,187,938	Stk. (£1)	Morgan Crucible A	56/–		14	13	5 0 0	71/3	53/4½	63/–	47/6
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	14/6		5½	5½	7 11 9	17/–	14/1½	18/9	15/9
3,850,000	Stk. (£1)	Murex	46/–	+5/–	13	22½J	5 13 0	52/–	39/9	45/–	35/3
585,000	5/–	Ratcliffs (Great Bridge) Ord. ...	16/3		10	10R	3 1 6	16/6	15/9	17/–	14/9
195,000	5/–	Ditto 8% Max. Ord.	5/–		8	—	8 0 0	5/1½	4/9	5/3	5/–
1,064,880	10/–	Sanderson Kayser	31/–		17½	35‡	5 13 0	41/3	29/–	40/3	27/7½
3,400,500	Stk. (5/–)	Serck	15/9	+6d.	12½	17½GD	3 19 6	19/3	14/9	25/6	15/3
8,035,372	Stk. (£1)	Stone-Platt Industries	55/–	+4/6	16	15	5 16 3	67/–	50/–	64/4½	52/3
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	14/–	+3d.	5½	5½	7 17 3	18/–	13/6	18/7½	15/3
35,344,881	Stk. (£1)	Tube Investments Ord.	67/6	+1/3	14	20	4 3 0	85/6	66/3	140/3	63/10½
41,000,000	Stk. (£1)	Vickers	35/–	+2/6	10	10	5 14 3	38/3	28/–	39/7½	27/1½
750,000	Stk. (£1)	Ditto Pref. 5%	14/–		5	5	7 2 9	15/–	12/7½	17/6	13/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	18/6	—3d.	•5	•5	8 0 3A	21/1½	18/3	24/6	20/1½
4,594,418	1	Ward (Thos. W.) Ord.	72/6	+3/6	13¾	25	3 15 3	84/6	64/6	94/–	63/–
7,109,424	Stk. (£1)	Westinghouse Brake	34/–	+6d.	11	10	6 9 6	46/3	32/6	60/6	37/6
323,773	2/–	Wolverhampton Die-Casting ...	8/9	+6d.	35	30	8 0 0	13/4½	8/3	13/10½	8/1½
591,000	5/–	Wolverhampton Metal	23/–	+6d.	32½	32½	7 3 6	30/–	22/6	39/9	23/9
156,930	2/6	Wright, Bindley & Gall	4/4½	+1½d.	15	20‡	8 11 6	4/9	3/7½	4/6	2/10½
124,140	1	Ditto Cum. Pref. 6%	13/–		6	6	9 4 6	13/7½	13/–	15/–	13/6
150,000	1/–	Zinc Alloy Rust Proof	4/6		40	30	8 17 9	5/6	4/6	5/4½	4/–

•Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. ••Shares of no Par Value. ‡and 100% capitalized issue. •The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. D and 50% capitalized issue. C paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. R and 33⅓% capitalized issue in 8% Maximum Ordinary 5/– Stock Units. φ and 6½% from Capital Profits. B and 50% capitalized issue. G And 50% capitalized issue. F and special 5% tax free dividend and 50% Capitalized issue. H As forecast. ¶And 3 for 7 capitalized issue. L and 33⅓% capitalized issue. M and 10% capitalized issue. J and 75% capitalized issue. S and 40% capitalized issue. O calculated at 13⅓%. Interim on smaller capital. P calculated at 11⅓% Q also 1/– special tax free dividend and 50% capitalized issue. T Per £1 unit. Z After capital reorganization. The Thomas Bolton Capital has been acquired by British Insulated Callender's Cables. K Forecast dividend.

ARM

Equipment





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COMPANY MEETING

THE WOLVERHAMPTON METAL CO.

ADVERSE TRADING CONDITIONS BUT PROMISING START TO CURRENT YEAR

The 58th annual general meeting of the Wolverhampton Metal Company Limited was held on August 3rd, at Wolverhampton, Mr. James H. Furnival (the Chairman) presiding.

The following is an extract from his circulated statement:

Although at £381,404, profits are £84,004 less than last year, this result should not be considered without regard to the adverse trading conditions in which they were earned. In this context I am of the opinion that the result is satisfactory.

Conditions of trading in the year under review were in my opinion the most difficult for some years. The limited supplies of raw materials coupled with the fierce competition had the inevitable effect of narrowing our working margins. As previously we have processed some of our accumulated stocks of by-products and materials, thus obtaining some protection from the effect of competition.

In common with the rest of industry we have been faced with increased costs, particularly on labour and fuel. We took steps to offset the effect of these adverse factors by increasing the efficiency of the production units and by making substantial reductions in our expenses.

In 1960/61 there were significant fluctuations in metal prices. Between the opening and the closing of our financial year, the price of copper fell by £30 5s. 0d. per ton; opening at £255, it rose to a peak of £279 10s. 0d. in late April, 1960, fell to £216 10s. 0d. in January, 1961, after which there was an upward trend with a price of £224 15s. 0d. at the year end. As far as possible we adjusted our trading policy to meet market variations.

Valuable contributions to the profits of the Group were made by our Subsidiary Companies.

In my Statement last year I referred to our proposed capital expenditure programme, part of the cost of this appearing as the increase of £133,790 in Group Assets from £1,058,395 to £1,192,185. The major part of this increase is in respect of improvements in our buildings, plant and general production facilities with the help of which we have been able to maintain a reasonable level of profit in difficult conditions.

CONSOLIDATED PROFIT AND LOSS ACCOUNT

Group Profit is £381,404 after making the usual charges including £105,037 for depreciation. Certain annuities have been purchased for a Director and for employees over retiring age, the cost of which this year is £14,229. £2,000 has been contributed to the Employees' Service Fund and £182,356 is required for taxation. After providing for these items and the Minority Interest of £4,301, the amount available for appropriations and distribution is £178,518 as compared with £243,222 last year.

The Board, after giving careful consideration to this matter, decided to recommend a Final Dividend of 17½% plus a Bonus of 5% both less Income Tax. The Board feel justified in recommending the same total distribution as in the two previous years having regard to the substantial revenue reserves, the strong liquid position and a promising start to the current financial year.

The order book is satisfactory and our plant is fully employed. Our reputation is high and the trade recognises the quality of our products—brass, bronze, aluminium etc., ingots and billets from Wednesfield and electrolytic cathode copper from James Bridge Copper Works Ltd. We have an excellent name for service.

Unless any unforeseen circumstances occur I feel that we can face the future with confidence.

At the subsequent Extraordinary General Meeting a resolution adopting new Articles of Association was approved.

The Report and Accounts were adopted.

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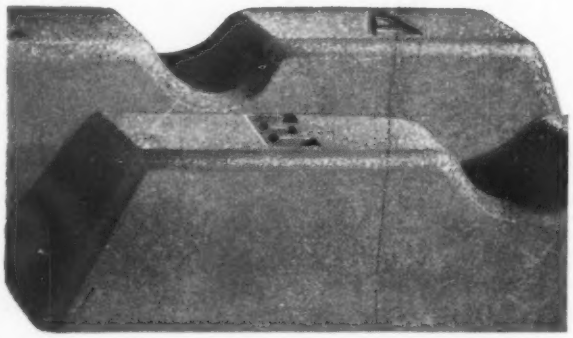

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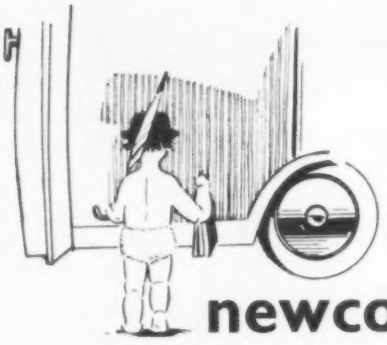

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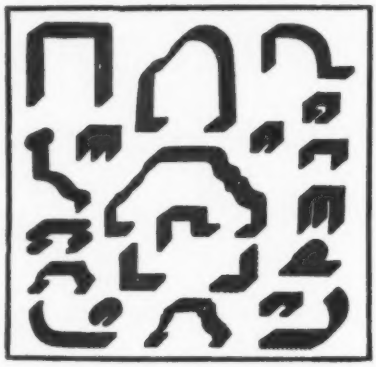

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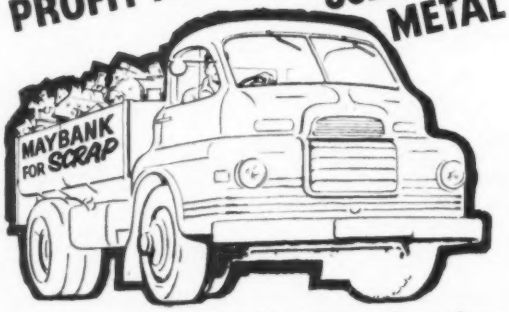

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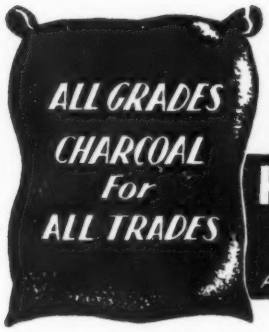

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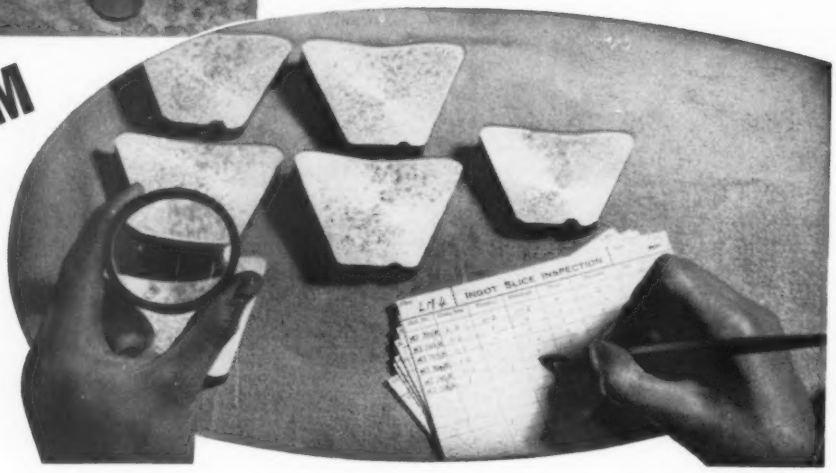

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